THE WEATHER AND CIRCULATION OF NOVEMBER 1956

Another October to November Circulation Reversal[1]

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1. INTRODUCTION

Abrupt changes of the general circulation from October to November have been characteristic of recent years. In fact, for the period 1942–1950 Namias [1] found that the month-to-month persistence of precipitation, temperature, and 700-mb. height anomaly was less from October to November than for any other pair of adjacent months. This autumn conformed, and there was even less persistence (October to November) of all meteorological elements than the average for these recent nine years.

Namias also indicated that intramonthly fluctuations had been common in recent Novembers. During this November several different regimes were observed. For the first three weeks the variability of the weather was most pronounced; however, a more stable pattern did exist near the end of the month. The mean waves underwent large changes in amplitude, and the troughs and ridges oscillated between eastern and western United States. As a consequence, notable changes in the temperature and precipitation regimes resulted. Much of the variability in the circulation can be associated with prior changes in the mean waves over the Pacific.

When there are contrasting regimes during a month, it is sometimes difficult to discern in the monthly mean circulation underlying physical explanations of each feature of the temperature and (especially) precipitation anomalies. Nevertheless, an analysis of the mean circulation in terms of its height departure from normal helps to reveal the components of mean flow responsible for these weather anomalies. The concept of departure from normal flow (DN flow) will be used extensively in this review to relate circulation to weather. Hawkins [2] in the preceding article of this series gave justification for this procedure and an explanation of how to use the DN flow at 700 mb.

2. MEAN CIRCULATION AND WEATHER OF THE MONTH

Because of the varying regimes during this month, there were few outstanding features or large departures from normal of the monthly mean maps in the Western Hemisphere (fig. 1 and Charts I, II, III, and XI). The 700-mb. chart resembled the monthly normal [3], in the sense that the troughs and ridges were located near their normal positions. However, heights were below normal in the Pacific trough and above normal in the ridge along the North American west coast.

Rather weak, ill-defined DN flow and near normal heights east of the Continental Divide were associated with small temperature anomalies (Chart I–B). In this eastern area only Miami, Fla., reached an extreme temperature class, namely much below normal. (For class limit definitions cf. [1].) Positive temperature anomalies in the northern tier of States resulted from a deficiency of cold air in the northwestern source region. The warm conditions for the month in western Canada are attested by mean thickness for the layer 1000–700 mb. up to 140 ft. above normal (fig. 2) and by positive anomalies for the monthly mean surface temperature (as great as +16° F.) over an extensive area in the western Provinces [4]. These anomalously warm airmasses were not cold enough to produce below normal conditions when they were advected over the northern United States, where normal temperatures are relatively low. But these same airmasses produced subnormal temperatures as they moved southward into the States with higher normal temperatures. Adiabatic warming of these airmasses due to subsidence in their trajectories southward was minimized since the flow aloft in eastern United States was cyclonic during the invasions of polar air from the northwest and even averaged cyclonic for the month as a whole.

Temperatures in the western mountains of the United States, where anticyclonic conditions prevailed (Chart XI), were lowered by radiational cooling. This will be discussed further in section 4. In southwestern California an easterly DN flow (fig. 1 and Chart XI, inset) produced foehn winds whose warm, dry properties created an acute forest fire hazard.

Precipitation for the month as a whole was predominantly light, as the West, South, and Southeast received subnormal amounts, and only the Northern Plains and a small area around Arkansas received much more than the monthly average (Chart III). The arid conditions in the West can be associated with the northerly DN flow observable in figure 1, while the heavier but conservative

[1] See Charts I–XVII following p. 419 for analyzed climatological data for the month.

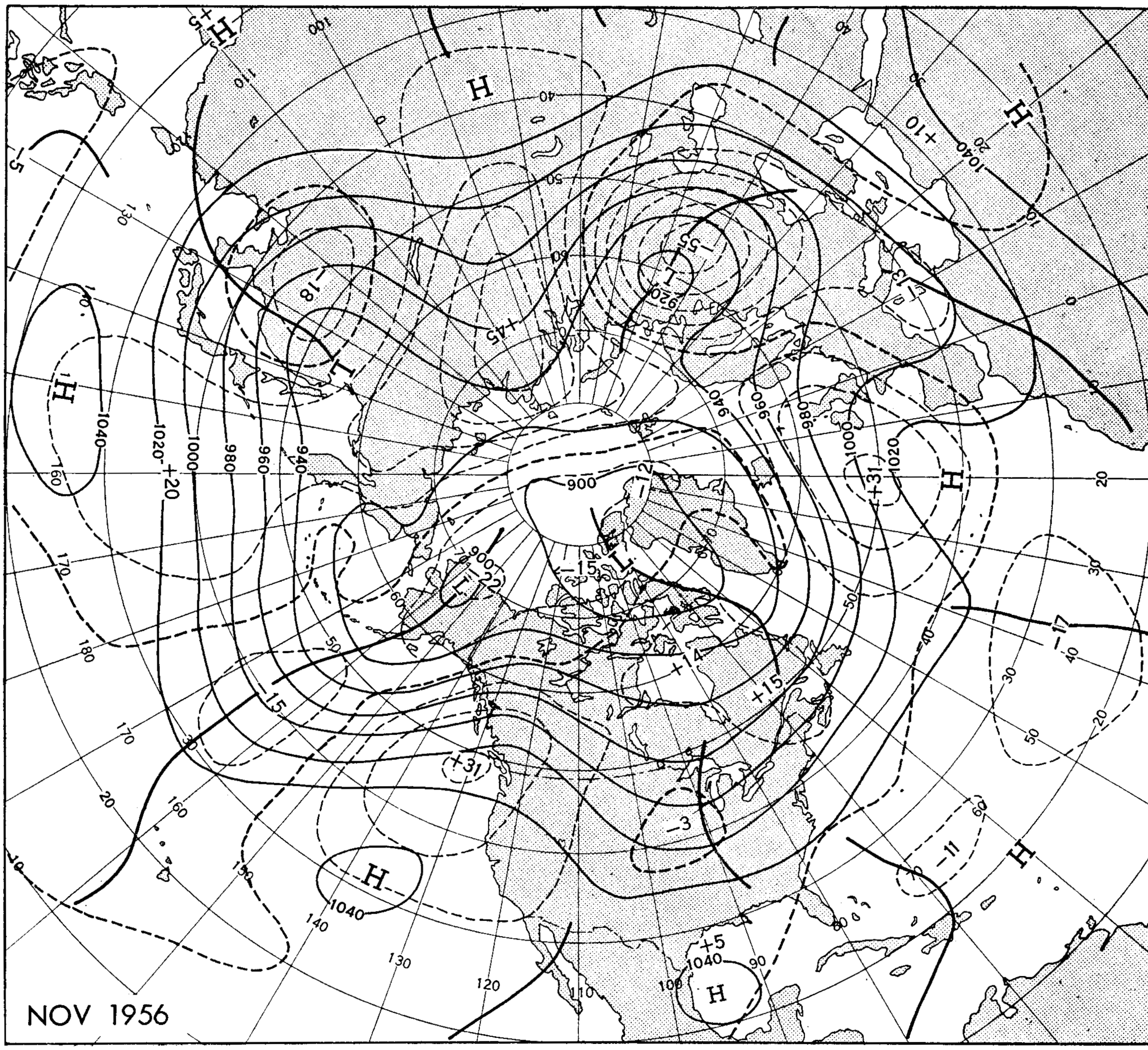


FIGURE 1.—Mean 700-mb. contours and height departures from normal (both in tens of feet) for November 1956. In the Western Hemisphere troughs and ridges were near the normal locations. Stronger than normal ridge in the West and weak trough in the East resulted in dry, cool weather in the United States.

amounts in the East occurred with a shallow mean trough and a deficiency of DN flow from the moisture sources.

3. REVERSAL FROM OCTOBER TO NOVEMBER 1956

The latitudinal wind speed profile for November (averaged over the Western Hemisphere) was similar to that of October since they both showed a northward displacement of the westerlies. This month the zonal winds were approximately 3 m. p. s. above normal north of 52° N., but roughly 3 m. p. s. below normal south of 52° N. (fig. 3). Also noteworthy was the emergence of a new relative maximum at about 38° N. which continued to develop and acted as a mechanism for displacing the westerlies southward in a discontinuous manner.

The similarity between October and November 1956 ends with the wind speed profile. Table 1 indicates that the absence during recent years of persistence from October to November was continued this fall. This reversal was most manifest in the 700-mb. lag correlation

TABLE 1.—*Measures of persistence of monthly mean anomalies in the United States area from October to November*

	1956	Average 1942–1950
700-mb. height (lag correlation)	−0.54	−0.30
Temperature (0 or 1 class change, percent)	51	58
Precipitation (0 class change, percent)	22	31

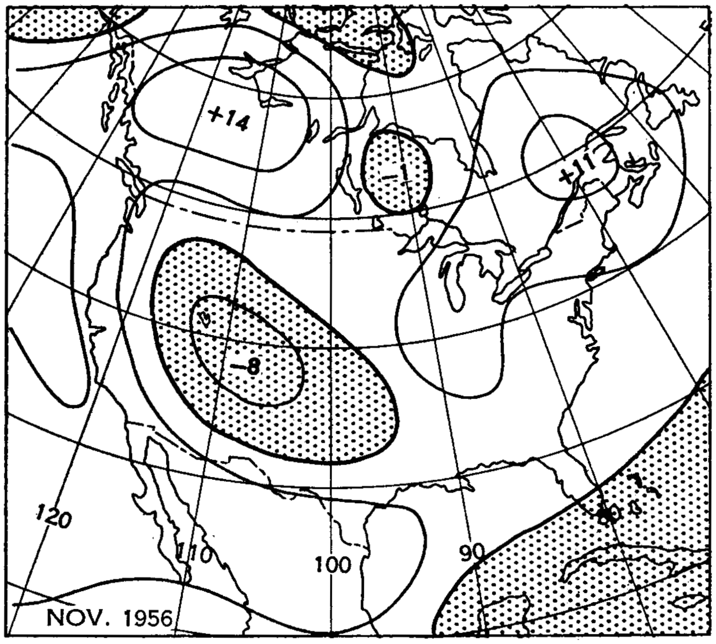


FIGURE 2.—Departure from normal (in tens of feet; 50-ft. isoline interval) of mean thickness of the 1,000–700-mb. layer for November 1956. Subnormal areas are stippled. Airmasses in the Canadian source region were abnormally warm.

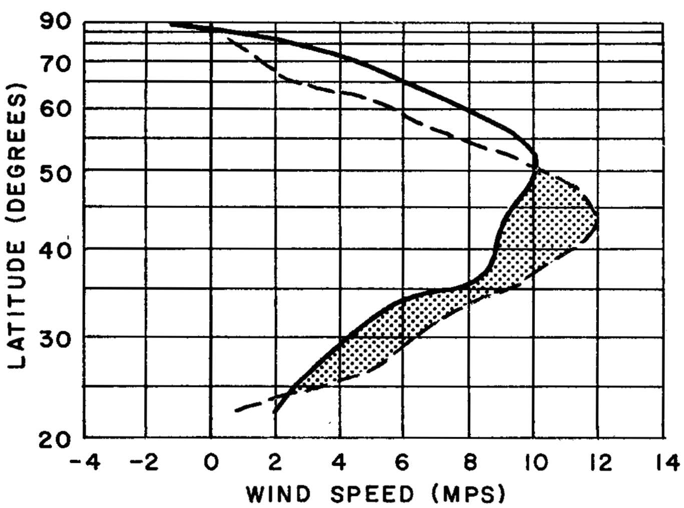


FIGURE 3.—Mean 700-mb. zonal wind speed profiles in the Western Hemisphere for November 1956 (solid) and November normal (dashed). Similar to October, the westerlies were above and below normal (stippled) north and south of 52° N., respectively.

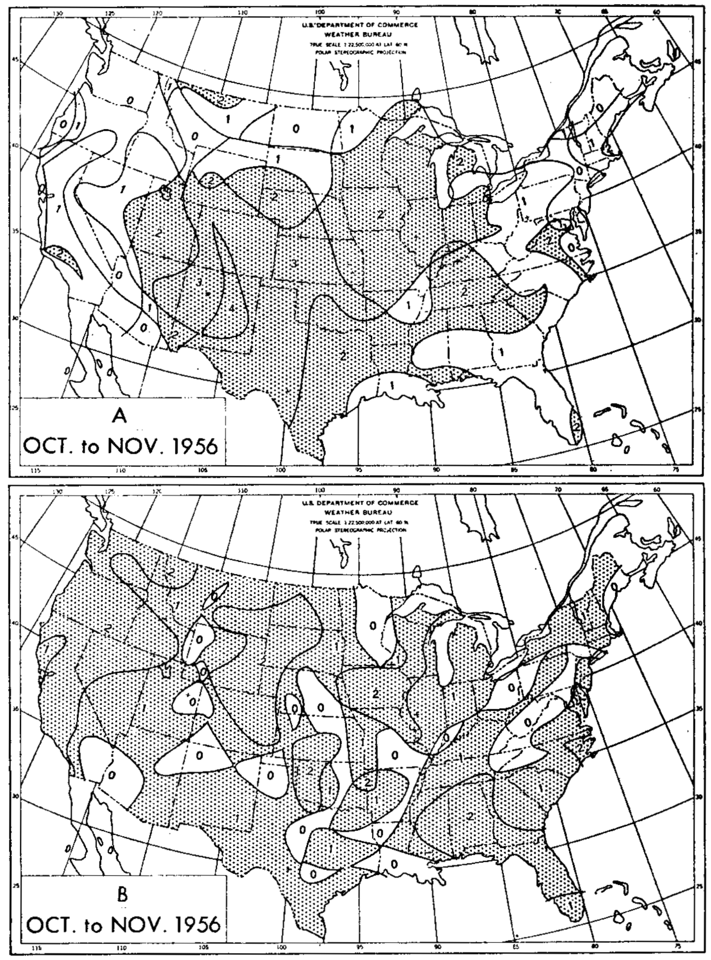


FIGURE 4.—Number of classes the anomaly of temperature (A) and precipitation (B) changed from October to November 1956. Lack of persistence observed during recent autumns was also characteristic of this year. Temperature anomalies changed notably in the Central Plains, and precipitation changed class in most areas.

of −0.54, but it was also reflected in the temperature and precipitation anomalies, which showed less than the expected small persistence for this time of year. The precipitation class changed at 78 percent of the stations in the United States. The temperature variation was not outstanding, but nevertheless it was greater than Namias' short-period average and what would be expected by chance. Unsmoothed charts of the class change of temperature and precipitation anomalies from October to November are shown in figure 4. There were only small scattered areas in which the precipitation class did not vary. The temperature class changes occurred mainly in the central portions of the country. Largest changes in temperature anomaly (from much above to below and much below normal) occurred in the southern Great Plains, where the DN flow reversed its direction from October to November. In some areas temperatures persisted from October, even though there was a change in circulation. A relevant example is the northern Great Basin area, which was cooled in October by an influx of cold maritime air under generally cyclonic conditions aloft [2], and remained cool in November under anticyclonic conditions, which enhanced radiational cooling (fig. 1 and Chart XI).

4. ANALYSIS BY WEEKLY PERIODS

Integrated with the October to November change in regime were the short-period, contrasting circulation and weather patterns of November. Variations of the 5-day mean zonal index (fig. 5) suggested that large circulation changes took place this month. Early in November the index was low, but it climbed rapidly to above normal values at mid-month, only to drop below normal again by month's end. In addition to the zonal index, a 700-mb. perturbation index, which is a measure of the average departure from normal meridional flow at 45° N., was computed from each available 5-day mean 700-mb. height departure from normal (computed routinely at the Extended Forecast Section three times each week) (fig. 5). The square of this perturbation index is a measure of the energy of the anomalous eddies. Here again, as with the zonal index, large variations occurred during November in the Western Hemisphere. An interesting sidelight was the out-of-phase relation between the zonal and perturbation indices. Apparently, the total wind speed was quasi-conservative as the zonal and meridional wind speed components varied inversely [5].

Because of this intramonthly variability, a dissection of the monthly mean was necessary to adequately review this month's circulation and weather. The two 15-day means showed that during the first half of November there was a predominance of cyclonic flow in the western United States and of anticyclonic flow in the East, followed by essentially the opposite pattern the second half of the month. However, further examination showed that during the first 15 days marked oscillations (about a week apart) of the circulation occurred, and it became apparent that dividing the month into approximate 7-day periods was desirable. Therefore five consecutive 5-day mean charts one week apart were selected to represent the different patterns that were observed this month (fig. 6). These selected periods also correspond to periods of high zonal and low perturbation indices and vice versa. The concomitant weekly mean temperature anomalies and precipitation amounts from the *Weekly Weather and Crop Bulletin, National Summary,* [6] are also displayed (figs. 7, 8).

A. First week.—This period (fig. 6, Oct. 30–Nov. 3) was characterized by a large-amplitude, short wavelength flow, as suggested by the high perturbation index (fig. 5). Anticyclonic flow in the Northeast was retained from October [2]. The trough which previously had been along the west coast progressed rapidly into the Great Plains, where it was accompanied by vigorous cyclonic activity. Cold maritime air flooded the West under cyclonic flow and below normal heights at 700 mb. As a result the Southwest had the coldest average weekly temperatures (anomaly-wise) for the United States during the entire month (fig. 7.) This contrasted sharply with warm weather in the Northeast, as shown by an extreme difference of 30° F. in weekly temperature anomaly between Arizona and Michigan.

Precipitation which fell along the west coast (see fig. 8) was associated with cyclonic 700-mb. flow with a stronger than normal component against the mountains. Heavy rains, snowstorms, and blizzards were reported in areas of the Central Plains which were near the upper mean trough. In this region cyclonic flow aloft and strong DN flow from the Gulf of Mexico combined to produce sizable amounts of precipitation (up to 4 inches in Texas). Along the eastern seaboard strong easterly DN flow was associated with heavy rainfall. In fact, as the wavelength shortened over the States and the ridge in the

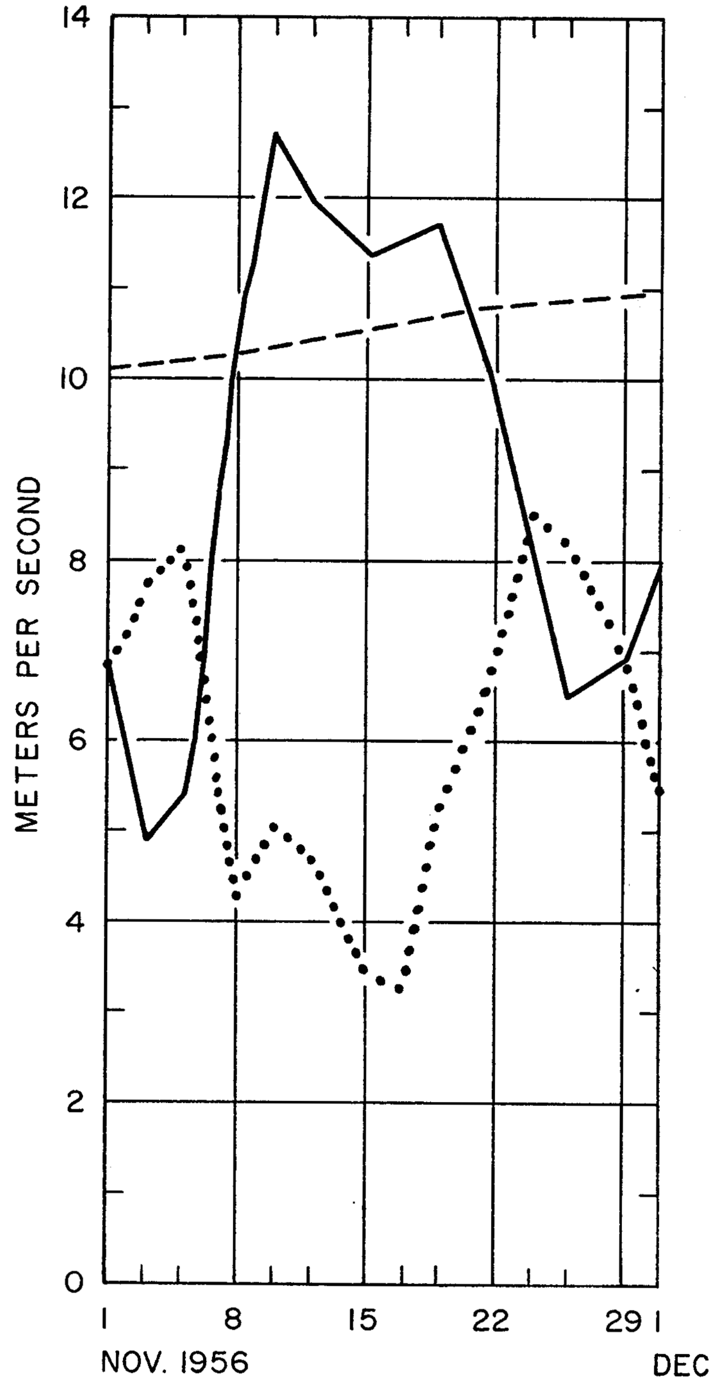
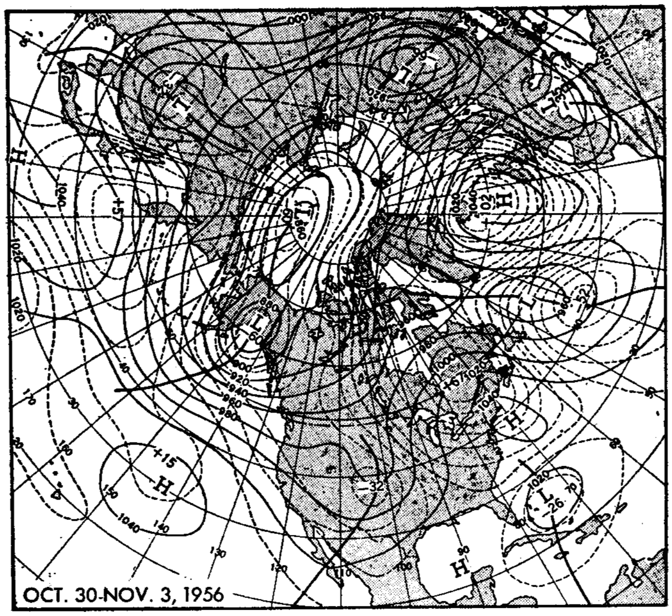
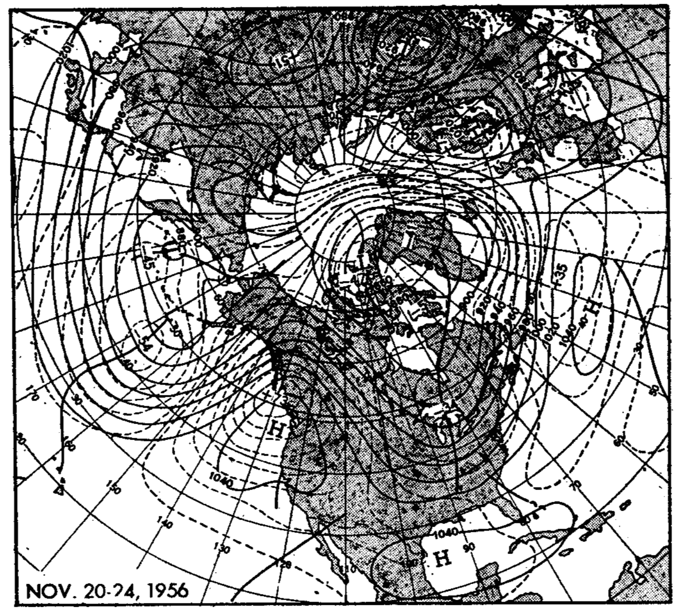
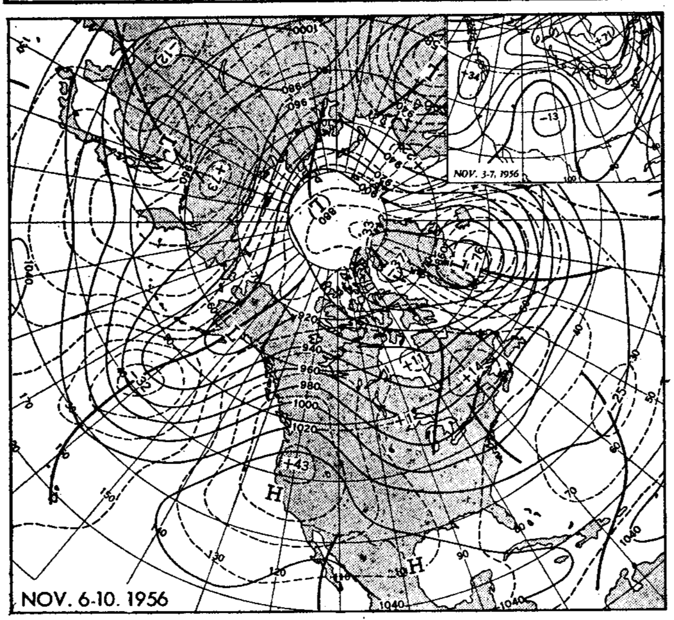
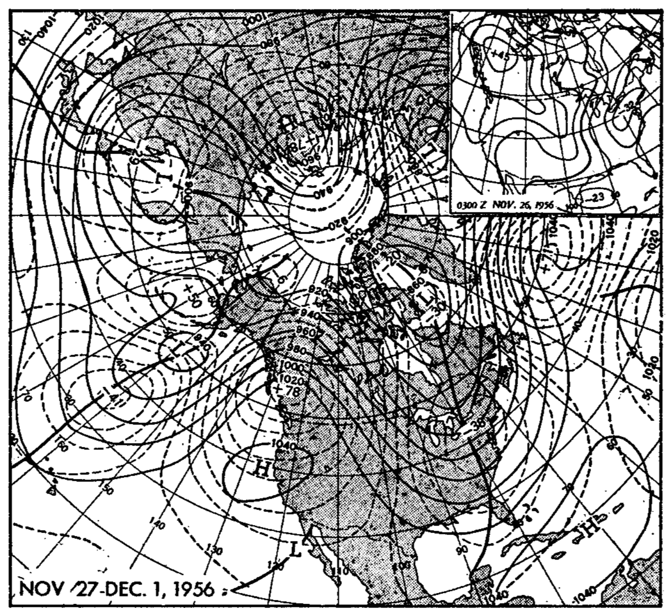


FIGURE 5.—Time variation of temperate-latitude zonal index (average strength in meters per second of 700-mb. zonal westerlies between 35° N. and 55° N. and from 5° W. westward to 175° E.) for November 1956. The solid line connects 5-day mean zonal index values (plotted at middle of the period). Dashed line shows variation of normal zonal index values. Dotted line is the time variation of the 5-day mean perturbation index (measure of the departure from normal meridional flow or the average of 10° longitude intervals of DN flow at 45° N. from 5° W. westward to 175° W.). Interesting out-of-phase relation existed between zonal and perturbation indices.









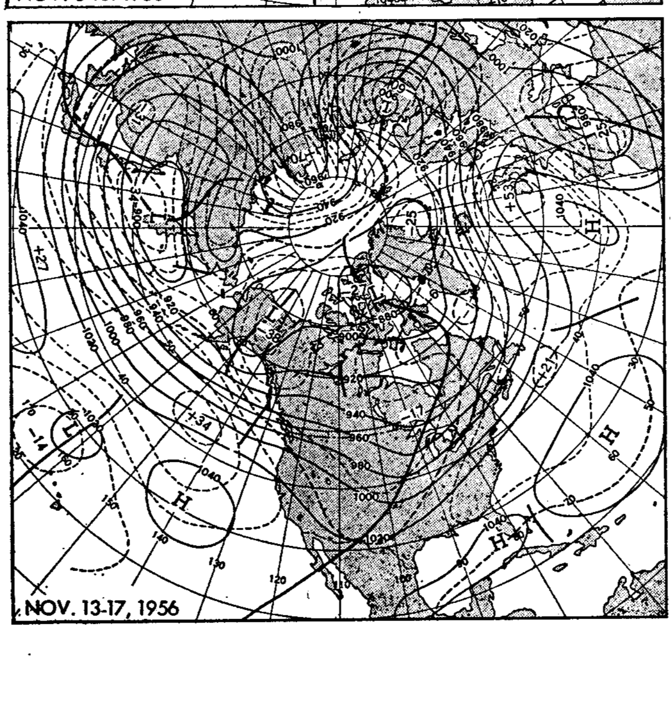
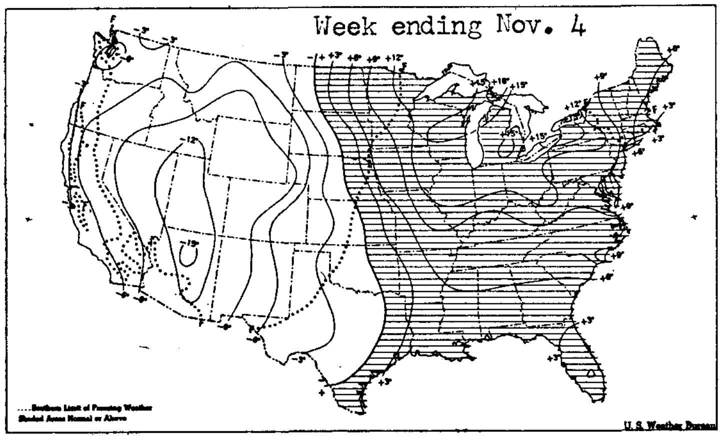
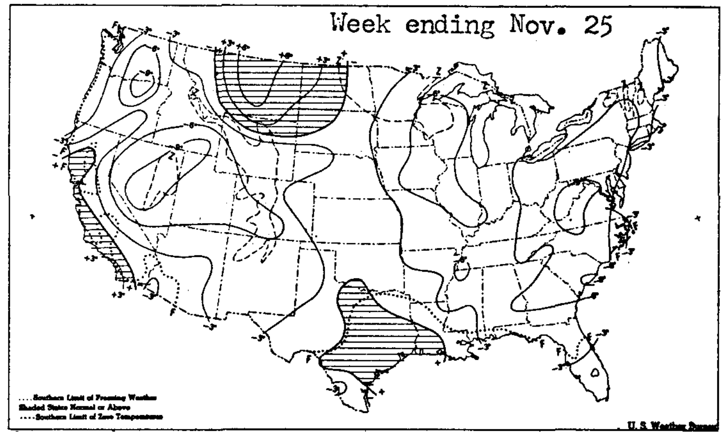
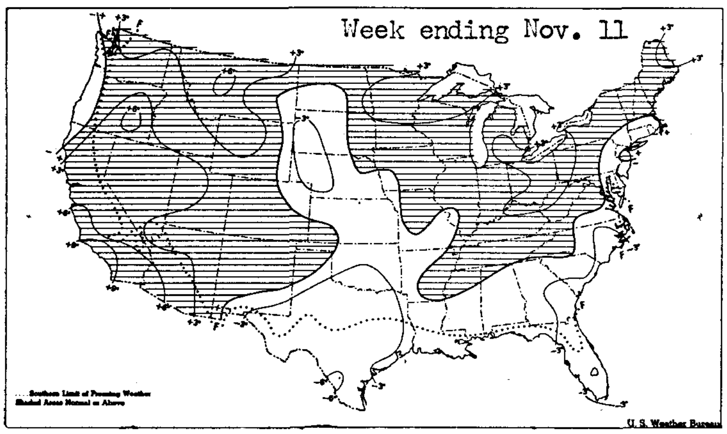
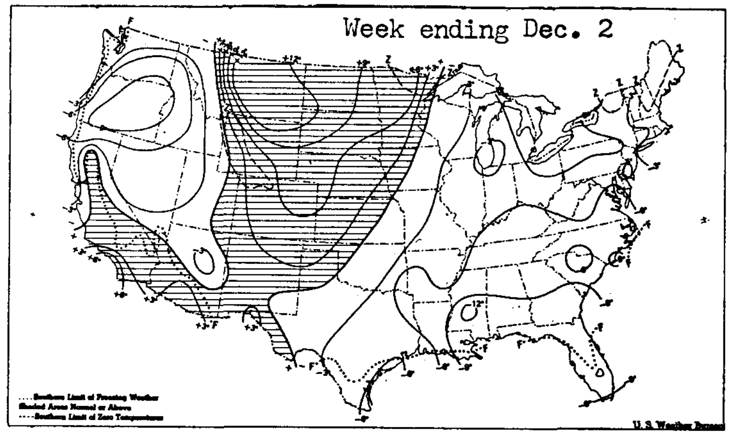


Figure 6.—5-day mean 700-mb. contours and height departures from normal (both in tens of feet) for selected periods in November 1956 one week apart. Lack of week-to-week persistence was outstanding aspect of November 1956. Inset in November 6–10 map is 5-day mean height departure from normal (tens of feet) for November 3–7, 1956. Inset in map for November 27–December 1 is the thickness departure from normal (tens of feet) of the layer 700–1,000 mb. for 0300 GMT, November 25, 1956.









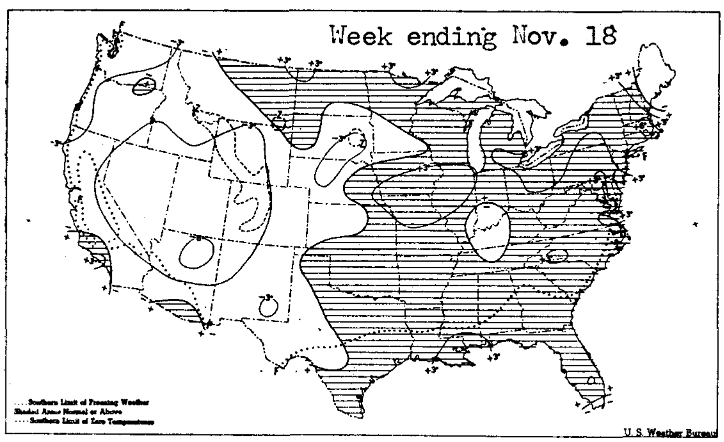


FIGURE 7.—Departure of average surface temperature from normal (° F.) for weeks in November 1956 centered on the 5-day mean periods shown in figure 6 (from [6]).

East became quite tenuous, widespread precipitation was observed but generally in small amounts.

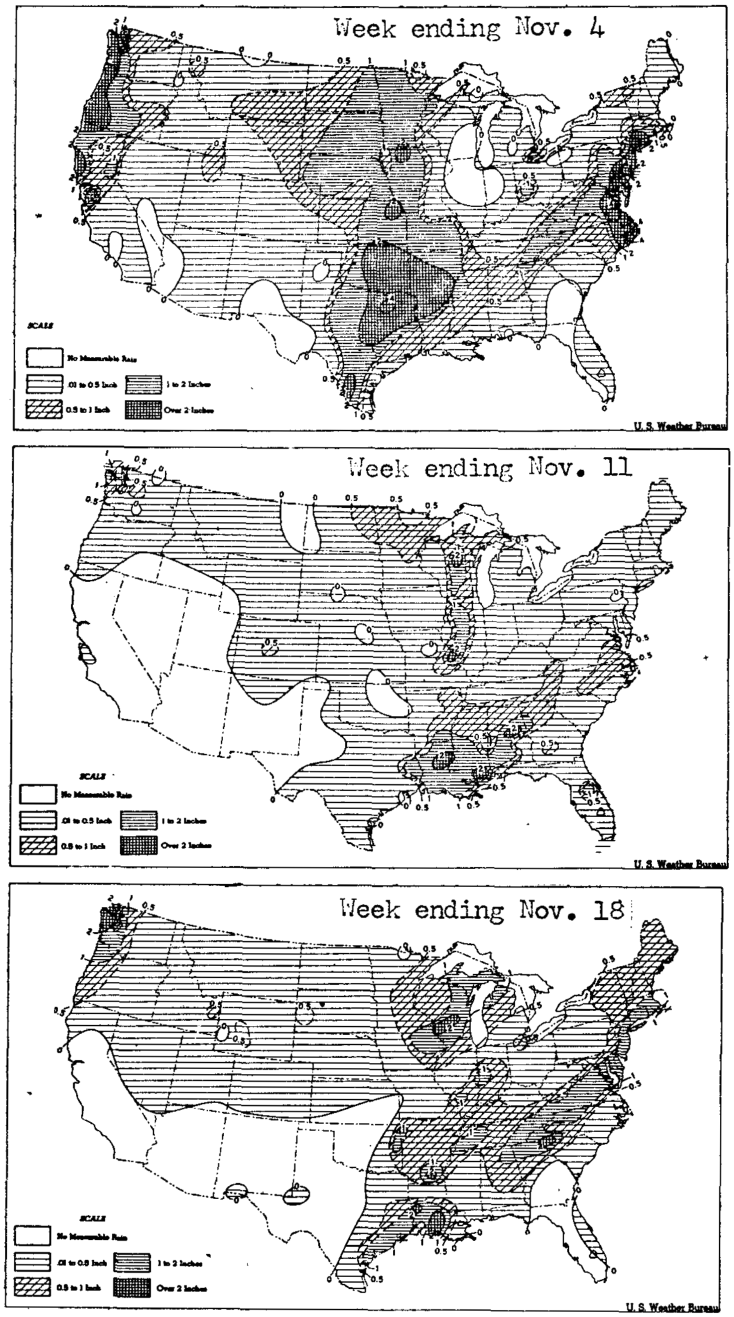
B. Second week.—Major changes from the first period occurred. The zonal index rose (fig. 5), the mean wave in the United States progressed eastward, there was a marked oscillation about the monthly normal of 700-mb. heights (fig. 6, Nov. 6–10), and a new temperature pattern was observed. In the West anticyclonic flow emerged and 700-mb. heights and temperatures rose in areas which previously had been below normal. In the East less oscillation was observed, but there was a definite trend toward more cyclonic and cooler weather. A northerly DN flow with a long fetch brought record cold and freezing temperatures to Florida on the 10th.

In general, precipitation amounts were much smaller than during the first week, especially in the western anticyclonic areas. The largest amounts of rainfall in the United States were observed in a narrow, north-south band in the Mississippi Valley.

Precipitation, a discontinuous element, is more difficult to explain in terms of the mean DN flow, especially when rapid circulation changes occur. Therefore, it is sometimes necessary to examine the component parts of the mean to find the explanation. The DN flow representative of the first part of the period, November 3–7, (fig. 6, Nov. 6–10, inset) when the precipitation occurred, was southerly and advected moist air from the Gulf of Mexico into the heavy rain areas. As the week's circulation evolved and northerly DN was introduced over almost the entire country, it is not surprising that the early wet period was followed by a desiccating trend, with less than 6 percent of the stations reporting precipitation by the 10th.

C. Third week.—The zonal index remained high, but there was a significant return to the first week's pattern. This was particularly true in the West, where 700-mb. heights averaged below normal. The east Pacific trough of the second week filled, creating a very long wavelength. This permitted the introduction of a new trough in the favored area (under fast westerly flow) to the lee of the Rocky Mountains (fig. 6, Nov. 13–17).

Cold Pacific air again invaded the West, reducing tem-



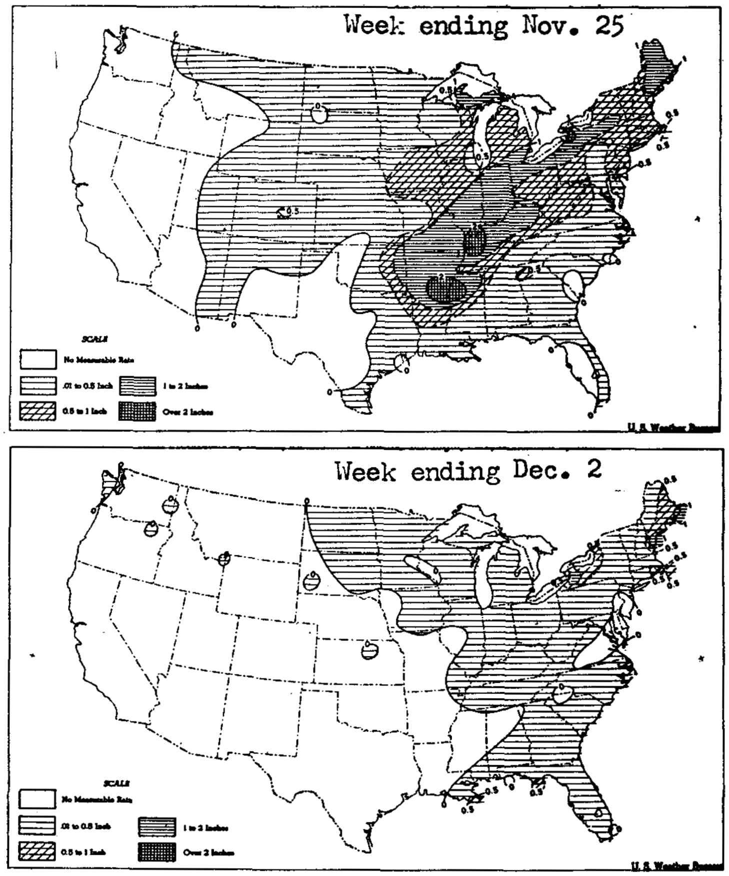


FIGURE 8.—Total precipitation (inches) for same weeks shown in figure 7 (from [6]).

peratures to subnormal values. In the East southerly wind components were associated with a general warming trend.

Sizable amounts of precipitation fell from the Central Plains eastward to the Atlantic Seaboard, associated with cyclonic winds aloft and southerly DN flow. On the Washington coast faster than normal westerly winds intensified the usual orographic precipitation.

D. Fourth week.—The return of a deep trough to the eastern Pacific effected another rapid readjustment of the circulation over the United States. The resulting pattern resembled the second week. The mean waves had a large amplitude, which is to be expected with a high perturbation index. Although this index was also high during the first week, only a superficial comparison of the maps for October 30–November 3 and November 20–24 reveals the major change in regime that had evolved in only four weeks. In both periods the waves had a large amplitude; however, these waves were positioned about 180° out of phase.

Large-amplitude flow aloft most often is associated with extreme weather. Over the eastern half of the country below normal 700-mb. heights and very strong northerly DN flow produced unseasonably cold weather. Cold, Arctic airmasses plunged southeastward and, in the process, replaced warm airmasses. This produced heavy snows in the Great Lakes area and severe weather reaching tornadic proportions in New England. Much of the week's precipitation was associated with one vigorous storm which originated in the Southern Plains on the 19th and subsequently moved northeastward through the Great Lakes. In the Southwest there was a continued absence of precipitation and fog. This was of particular interest since a serious forest fire problem continued to exist in California.

Although 700-mb. 5-day mean temperatures in the mountainous areas of the West increased and averaged above normal (not shown), surface temperatures failed to respond to the rising constant-pressure heights and increasing anticyclonic flow at 700 mb. Apparently, radiational cooling associated with the Great Basin High continued to cool the initially cold airmass and produced a very stable lapse rate near the ground. North-northeasterly DN flow undoubtedly assisted in keeping the West cool, except west of the mountains along the California coast where foehn winds were observed.

E. Fifth week.—The previous week's circulation is a climatologically favored and stable pattern [7]. Consequently, only minor adjustment was discernible in the fifth week, mainly some progression of the eastern trough and deepening in its southern portion. The observed ridge-trough orientation with its extensive, nationwide, northerly DN flow resulted in generally subnormal precipitation. Slightly above normal precipitation was reported in scattered areas of the Northeast, specifically along the Maine coast where there was onshore DN flow, and in western New York where Lake snows were intensified by cold, northwesterly flow. (See fig. 6, Nov. 27–Dec. 1.)

Very striking (temperature-wise) was the emergence of a warm tongue over the Great Plains. It first appeared during the third week but by this period had increased in both area and magnitude. Paradoxically, this warming was associated with northerly flow directly from the Canadian Arctic. The Great Plains, which has low normal temperatures, is sensitive to the initial airmass in the proximate source region. The daily thickness for the layer 700–1000 mb. at the beginning of the week (inset Nov. 27–Dec. 1, fig. 6) was considerably above normal over most of western Canada and Alaska, so that initially warm air dominated the source region. Furthermore, the westerlies were displaced northward over Canada, and foehn action maintained the warm conditions.

In other parts of the United States the temperature pattern resembled that of the previous week, when similar processes were operating. In the Southeast, where the greatest deepening at 700 mb. occurred, the cooling trend continued and resulted in a widespread freeze. In the Northwest surface temperature inversions, radiational fog, and drizzle persisted for days. It is noteworthy that cold surface temperatures in this area were accompanied by above normal thickness of the layer between sea level and 700 mb. This requires a very shallow surface inversion and further supports the radiational cooling explanation for subnormal temperatures in the northern Great Basin.

F. Summary.—This rather brief examination of the five weekly periods substantiates the a priori opinion that major circulation changes were prevalent in November. Additional analysis of a statistical nature produced significant and interesting results.

TABLE 2.—*Lag correlations for 5-day mean 700-mb. height anomalies in the United States area*

Periods (1956)	Correlation coefficient
Oct. 30–Nov. 3 to Nov. 6–10	−0.57
Nov. 6–10 to Nov. 13–17	−0.14
Nov. 13–17 to Nov. 20–24	−0.10
Nov. 20–24 to Nov. 27–Dec. 1	+0.77

Week-to-week persistence measures of 5-day mean 700-mb. height (lag correlation) were computed in the same manner as the month-to-month figures, for the five periods. (See table 2.) It is unfortunate that no climatological data for comparison are available, for these figures standing by themselves are of limited interest. Nevertheless their relative values indicate that November started with a marked oscillation followed immediately by essentially no week-to-week correlation, and ended with a highly persistent pattern. Now that the intramonthly variability has been established, the next logical investigation should be to seek its physical explanation. In this review only superficial scanning of the adjacent regions was possible, and the ultimate causes were not sought.

5. INTRAMONTHLY CIRCULATION IN UNITED STATES AND PACIFIC

Meteorologists by now are familiar with the way circulation changes in the Pacific affect the circulation in the United States. These upstream changes are propagated downstream by well-known mechanisms, such as vorticity advection and dispersion of energy.

This November, the eastern Pacific trough, which is directly linked to the circulation in the United States and is in turn responsive to changes of the Asiatic coastal trough, made a hasty departure and return. It became pronounced early in November, then filled rapidly as the Asiatic coastal trough moved out into the western Pacific. It was re-established when the former Asiatic trough continued to progress and reached the eastern Pacific (fig. 6).

Continuity of the 5-day mean negative height anomaly center associated with the progressive Asiatic trough is shown in figure 9. During the first two weeks, this center was quasi-stationary over Manchuria. Subsequently, it moved eastward, finally stagnating and intensifying in the eastern Pacific. This tenacious and well-defined cyclonic system continually applied a distorting force to the downstream flow. Its effect can best be seen in a slightly modified energy diagram (fig. 10) [8]. From the available 5-day mean height departures from normal, differences were computed for 10° longitude intervals at 45° N. in the Western Hemisphere. These differences in height anomaly are proportional to the meridional DN flow. (The average of these values from 5° W. to 175° W. was used to get the perturbation index referred to previously.)

On November 12 (mid-day of 5-day mean period) the meridional flow, except for a southerly band in the Atlantic, was neither strong nor well organized. There were many weak filaments of northerly and southerly flow. Three days later, November 15, the southerly flow in the western Pacific associated with the 340-foot negative anomaly center (fig. 9) began to intensify, and two previous filaments joined (fig. 10). Southerly flow then existed from 157° W. westward to Asia. This same band

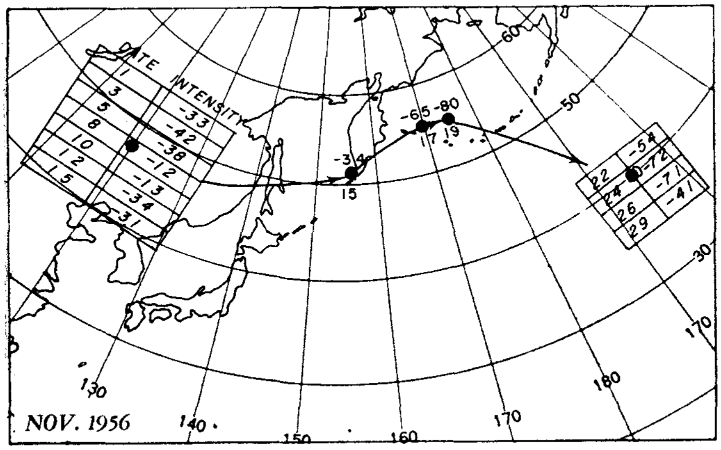


FIGURE 9.—Continuity of a 5-day mean 700-mb. height anomaly center (negative) during November 1956. Middle day of period plotted below circle or left side of box and central intensity in tens of feet above the circle or right side of box. Early in month anomaly was stagnant over Manchuria. Subsequently it moved into central Pacific and acted as an anchor point of the circulation.

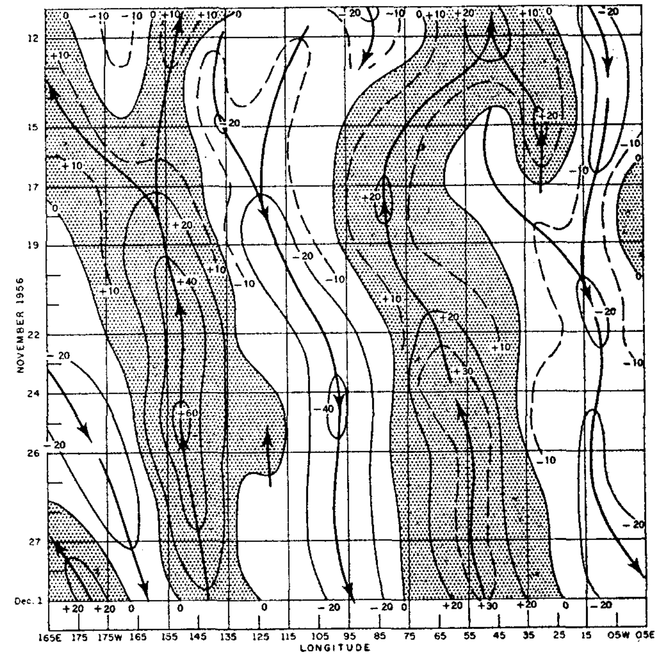


FIGURE 10.—Energy diagram or time cross-section of the 5-day mean anomalous meridional flow (tens of feet per 10° of longitude) at 10° longitude intervals at 45° N. from 5° E. westward to 165° E. Values are plotted at middle of periods. Wind components from the south considered positive. Southerly flow was established in the Pacific (147° W. to 165° E.) on November 15 and 17 and subsequently molded the flow over the United States.

of southerly flow continued to intensify and reached a maximum intensity about the 26th. As early as the 15th, there had been some increase in the northerly flow immediately downstream (147° W.–96° W.), and a definite trend toward amalgamation of the earlier and weak northerly filaments was discernible. This band of northerly flow continued to intensify, and the flow downstream over eastern United States and the Atlantic responded, so that by the 22d there were four pronounced rivers of meridional flow or two complete waves sympathetically spaced in climatologically favored areas. This arrangement, with a little progression, persisted the rest of November and is well exemplified by the 5-day mean charts for November 20–24, and November 27–December 1 (fig. 6).

In summation, the circulation of November started with a ridge in eastern and a trough in western United States. Far upstream, over Manchuria and the Yellow Sea, there was a stagnant and intensifying trough which favored and yielded a sympathetic trough in the eastern Pacific. Subsequently, vorticity flux from the latter trough introduced a ridge and trough into western and eastern United States respectively, and an oscillation in the States had occurred. Then the Asiatic trough, subjected to seasonal alterations, left the Asiatic mainland and continued to progress across the Pacific. This progression, due mainly to wavelength considerations, no longer favored a trough in the eastern Pacific but instead farther downstream. Heights at 700 mb. rose in the eastern Pacific and fell over western United States from the second to third week, and cyclonic flow returned to western portions of the United States. Later, the former Asiatic perturbation progressed to the eastern Pacific, where it stagnated. This trough favored the reappearance of the ridge in western United States and the trough downstream. The stable pattern of the end of the month had been established.

It appears that as winter approached and the seasonal change in the heat sources and sinks occurred, accompanying adjustments were necessary in the general circulation [1]. These seasonal alterations, in the United States at least, did not take place in a smooth, uniform fashion, but rather through marked fluctuations in the week-to-week circulation. Consequently, this November most areas of the United States experienced periods of both late summer and precursory winter weather.

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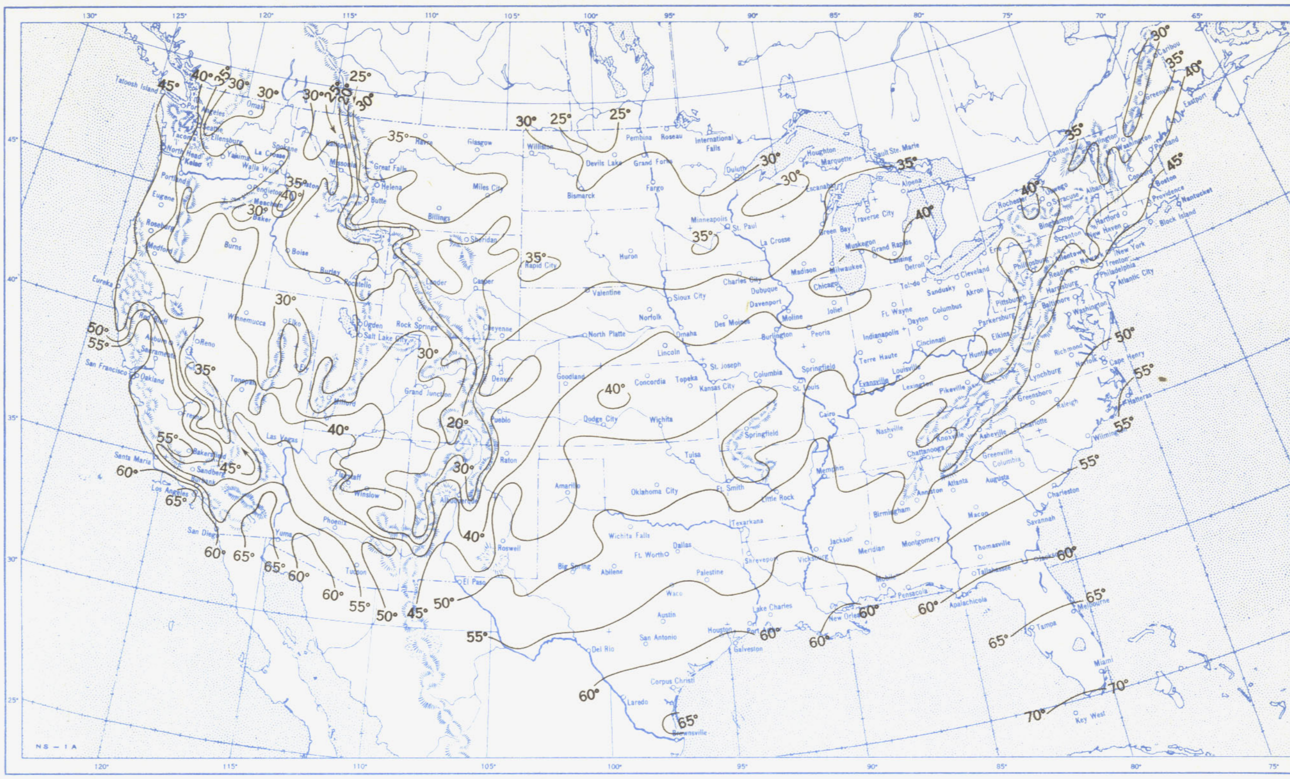
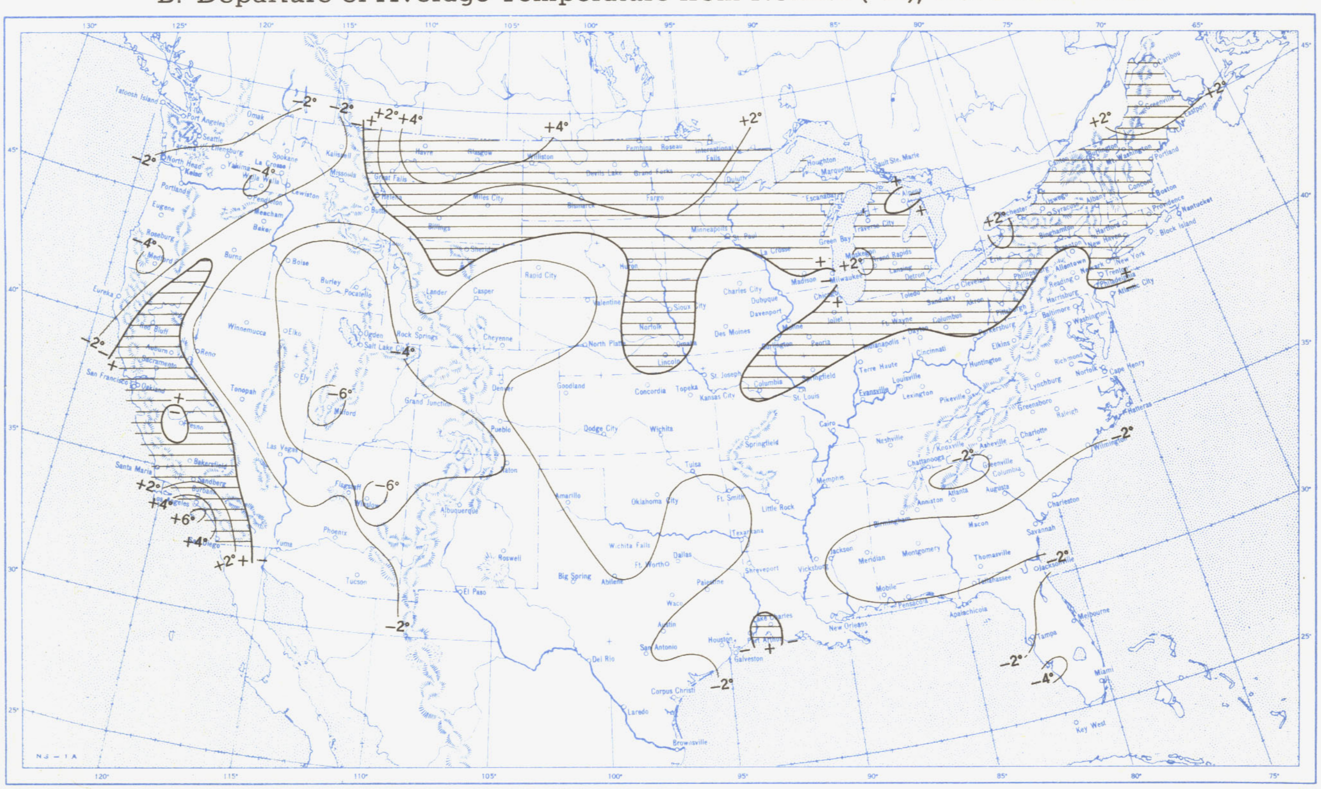
8. E. Hovmöller, "The Trough-and-Ridge Diagram," *Tellus*, vol. 1, No. 2, May 1949, pp. 62–66.

Chart I. A. Average Temperature (°F.) at Surface, November 1956.



B. Departure of Average Temperature from Normal (°F.), November 1956.

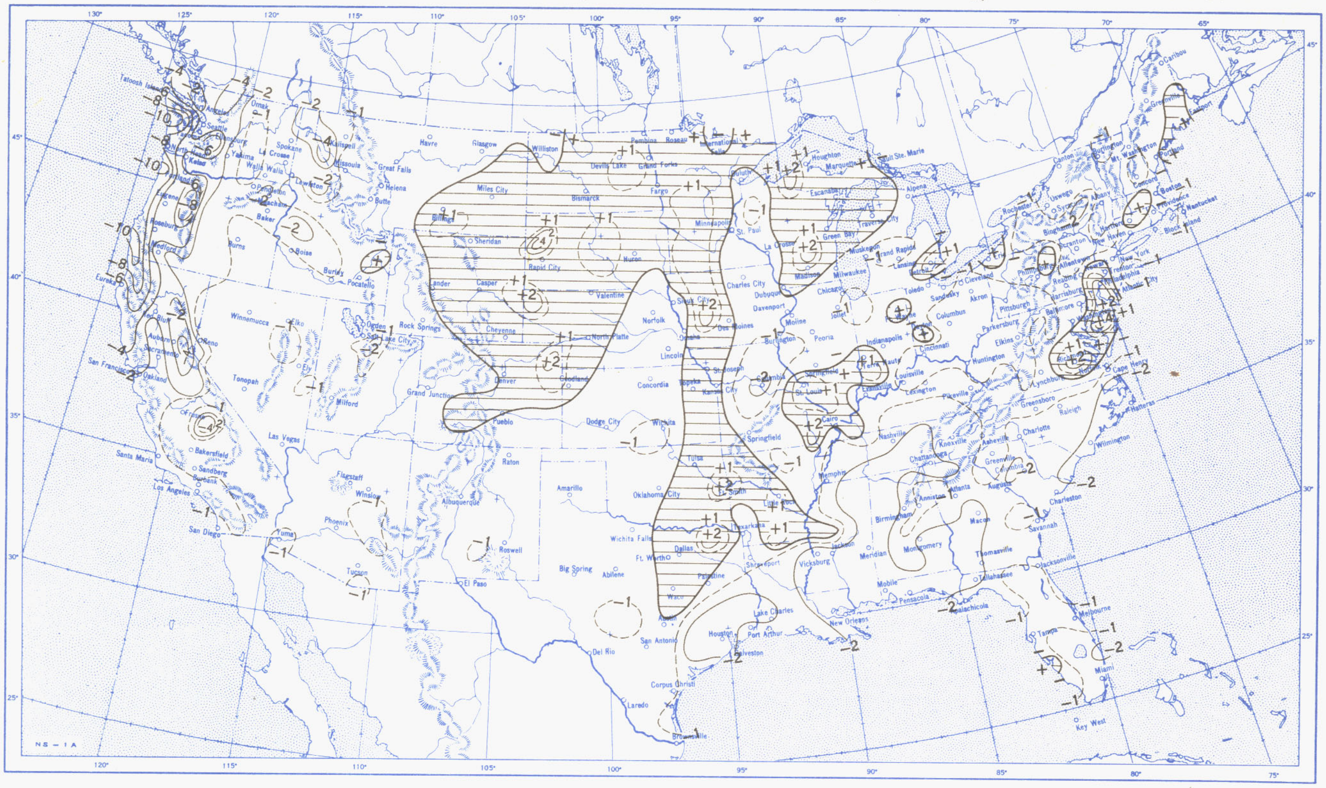


A. Based on reports from 800 Weather Bureau and cooperative stations. The monthly average is half the sum of the monthly average maximum and monthly average minimum, which are the average of the daily maxima and daily minima, respectively.
B. Normal average monthly temperatures are computed for Weather Bureau stations having at least 10 years of record.

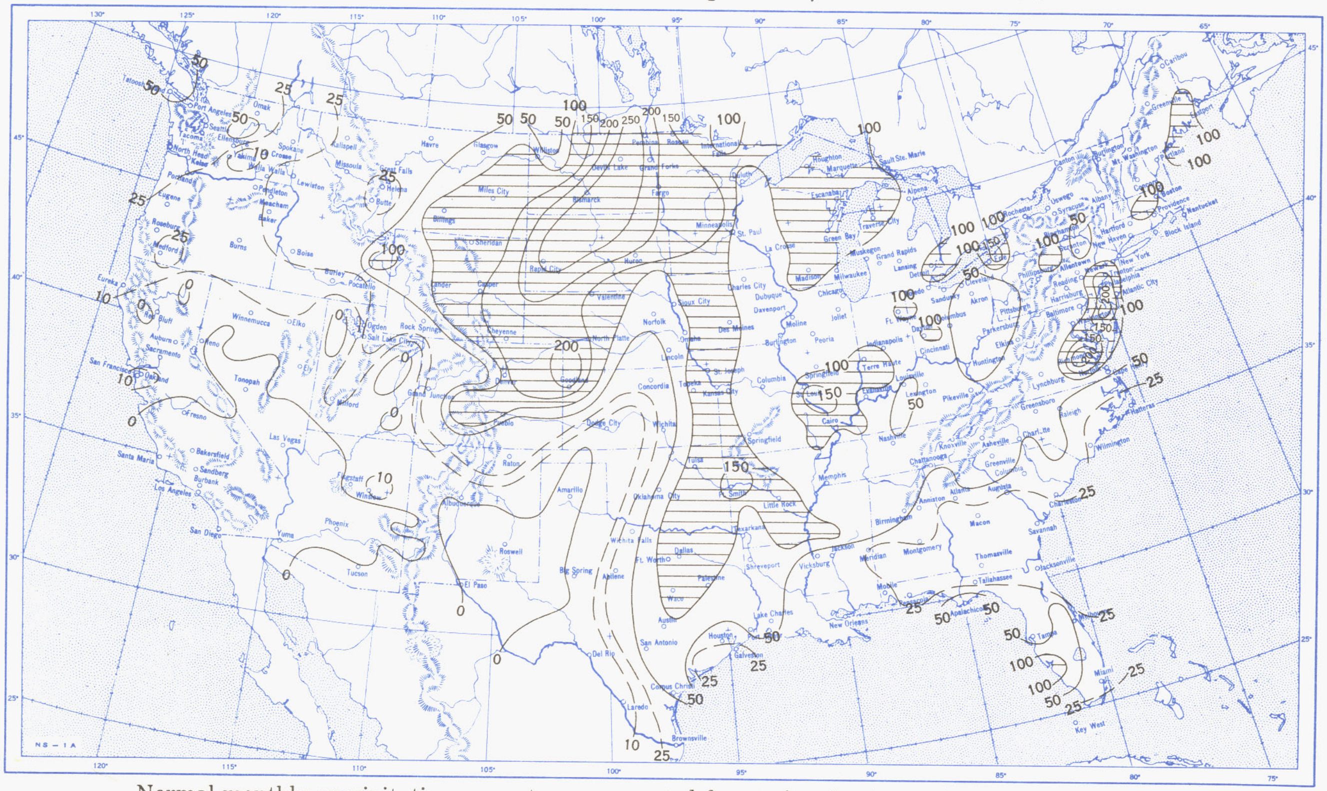
Chart II. Total Precipitation (Inches), November 1956.

Based on daily precipitation records at 800 Weather Bureau and cooperative stations.

Chart III. A. Departure of Precipitation from Normal (Inches), November 1956.



B. Percentage of Normal Precipitation, November 1956.

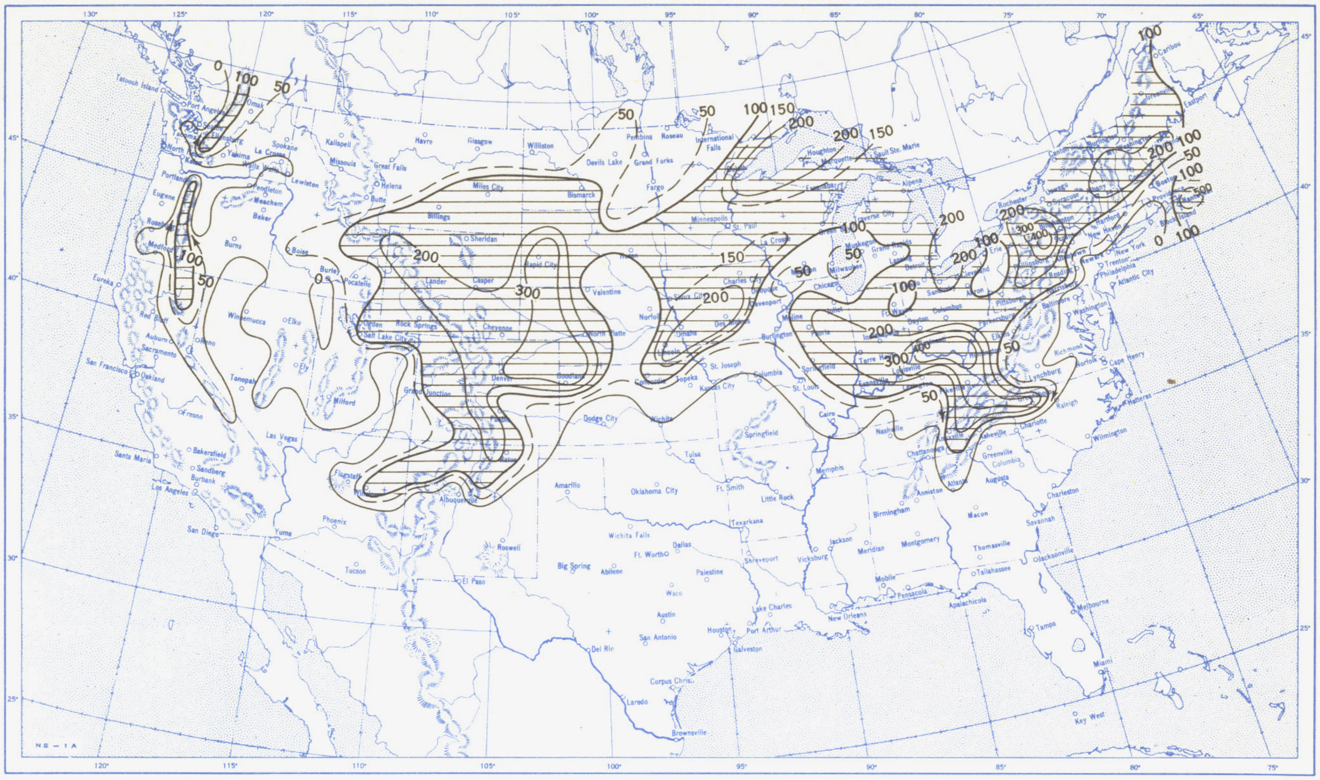


Normal monthly precipitation amounts are computed for stations having at least 10 years of record.

Chart IV. Total Snowfall (Inches), November 1956.

This is the total of unmelted snowfall recorded during the month at Weather Bureau and cooperative stations. This chart and Chart V are published only for the months of November through April although of course there is some snow at higher elevations, particularly in the far West, earlier and later in the year.

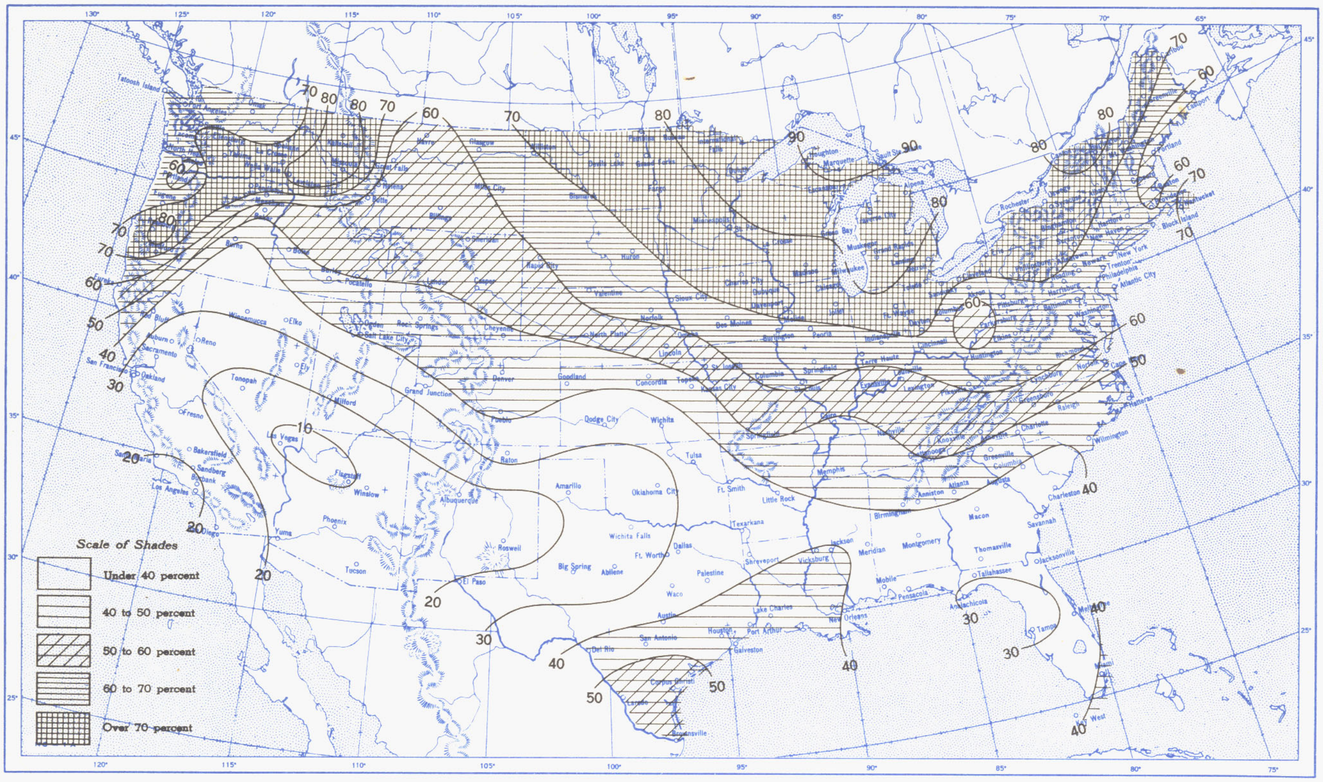
Chart V. A. Percentage of Normal Snowfall, November 1956.



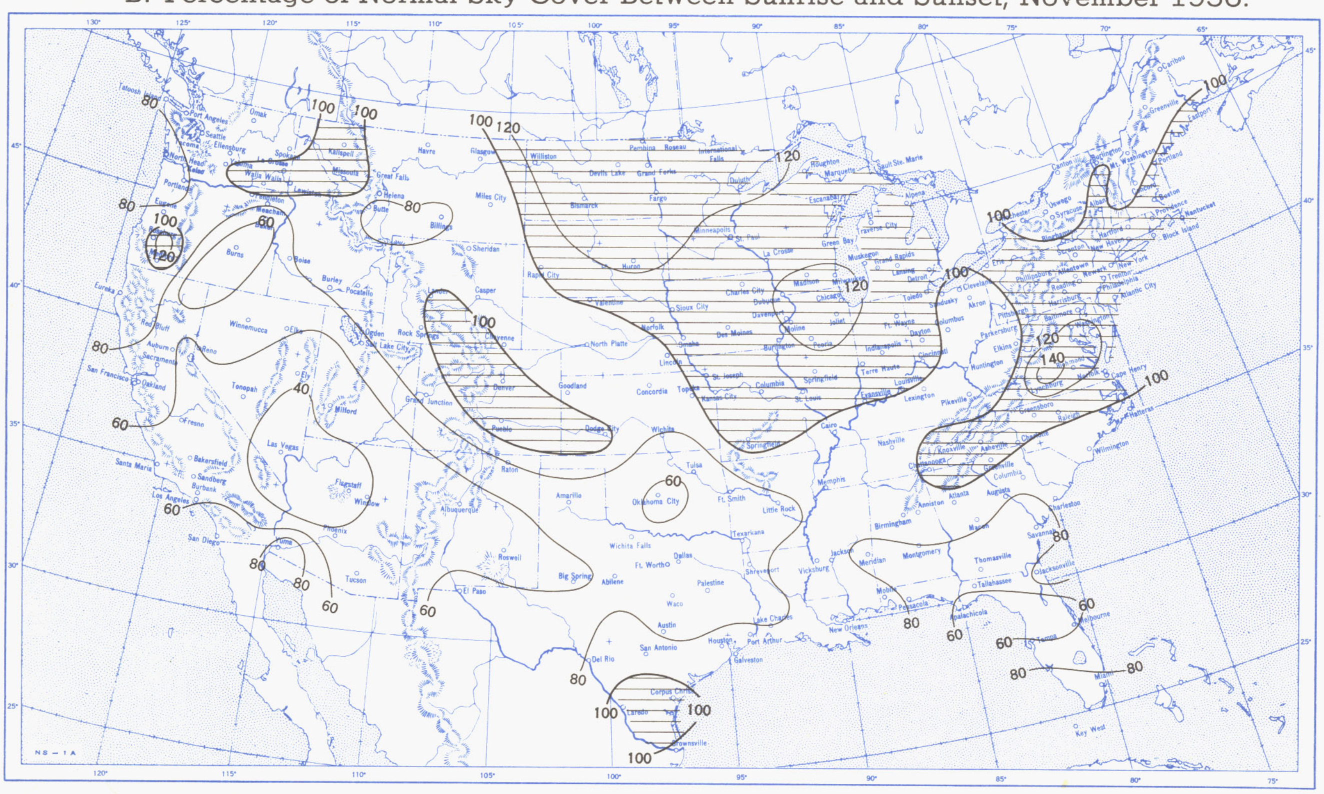
B. Depth of Snow on Ground (Inches).

A. Amount of normal monthly snowfall is computed for Weather Bureau stations having at least 10 years of record.
B. Shows depth currently on ground at 7:30 a. m. E.S.T., of the Tuesday nearest the end of the month. It is based on reports from Weather Bureau and cooperative stations. Dashed line shows greatest southern extent of snowcover during month.

Chart VI. A. Percentage of Sky Cover Between Sunrise and Sunset, November 1956.

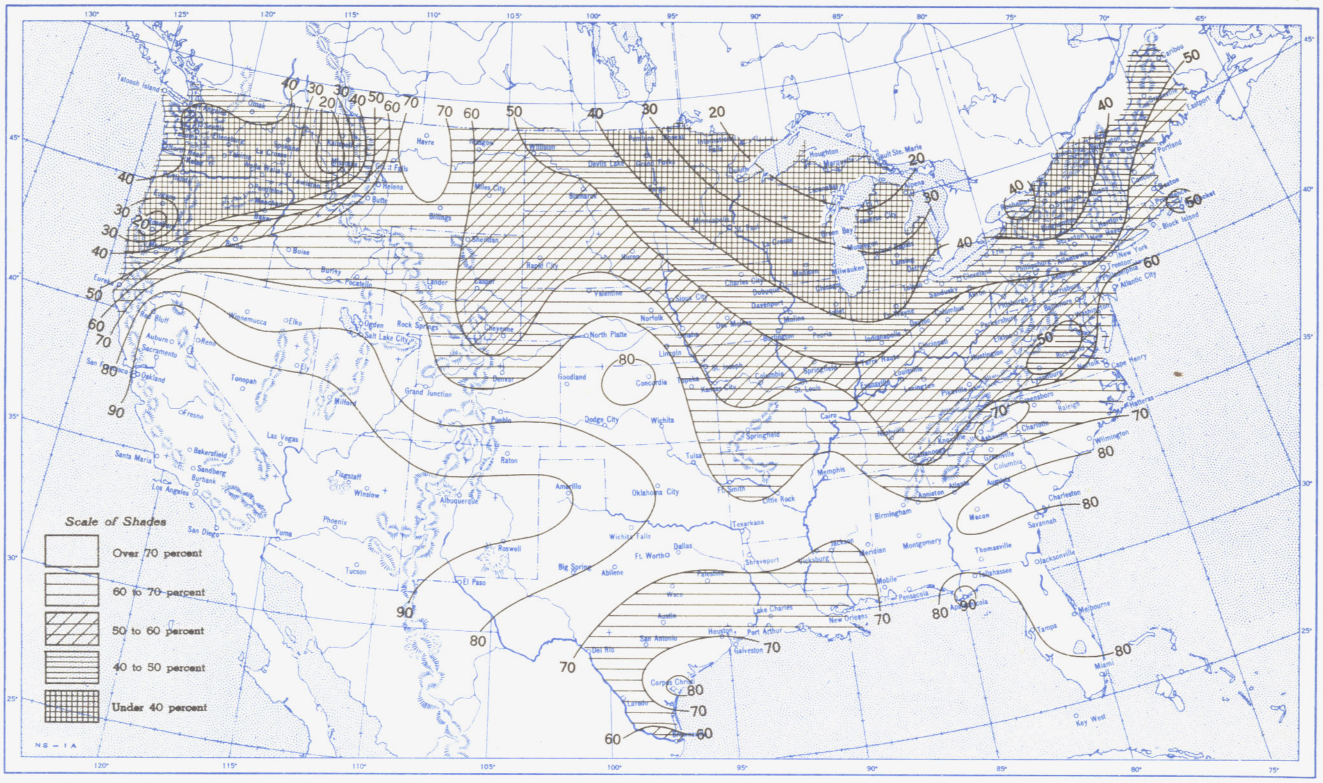


B. Percentage of Normal Sky Cover Between Sunrise and Sunset, November 1956.

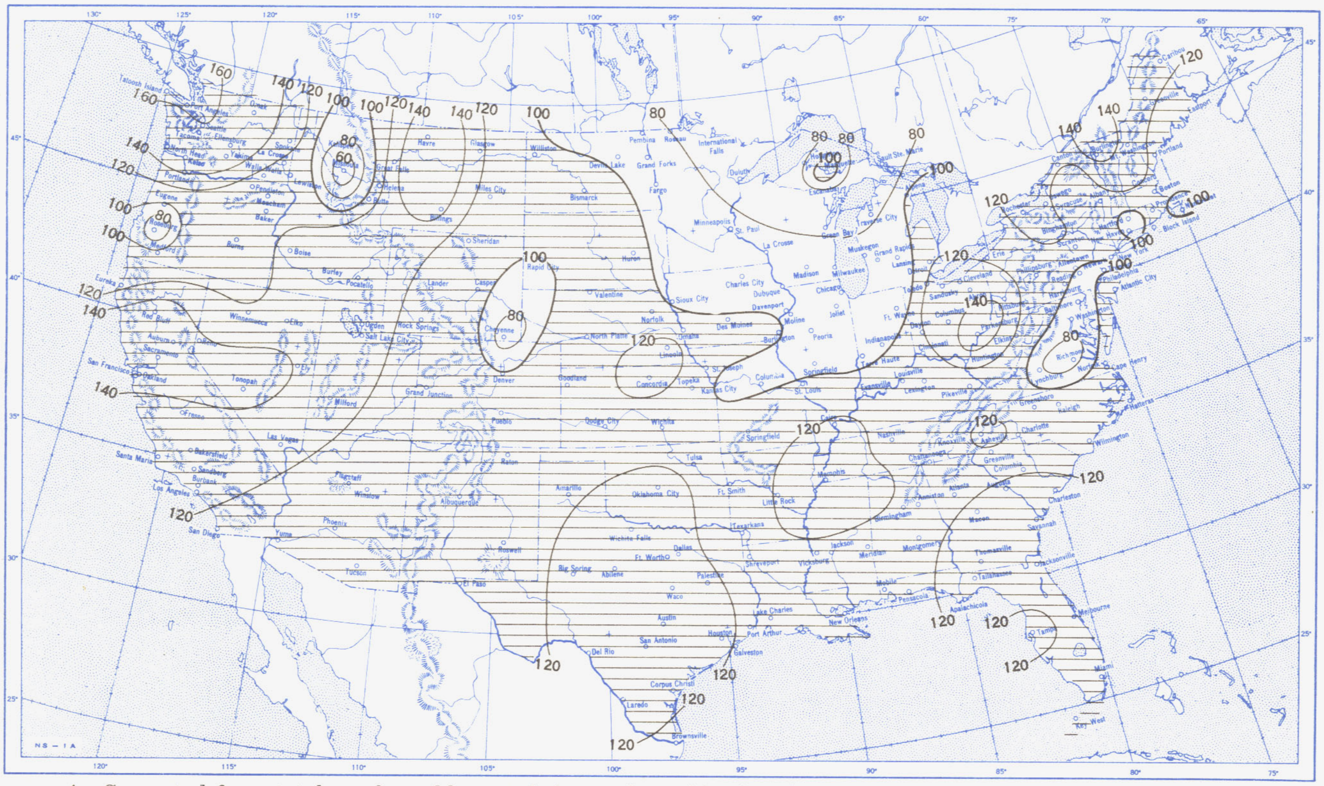


A. In addition to cloudiness, sky cover includes obscuration of the sky by fog, smoke, snow, etc. Chart based on visual observations made hourly at Weather Bureau stations and averaged over the month. B. Computations of normal amount of sky cover are made for stations having at least 10 years of record.

Chart VII. A. Percentage of Possible Sunshine, November 1956.



B. Percentage of Normal Sunshine, November 1956.



A. Computed from total number of hours of observed sunshine in relation to total number of possible hours of sunshine during month. B. Normals are computed for stations having at least 10 years of record.

Chart VIII. Average Daily Values of Solar Radiation, Direct + Diffuse, November 1956. Inset: Percentage of Mean Daily Solar Radiation, November 1956. (Mean based on period 1951-55.)

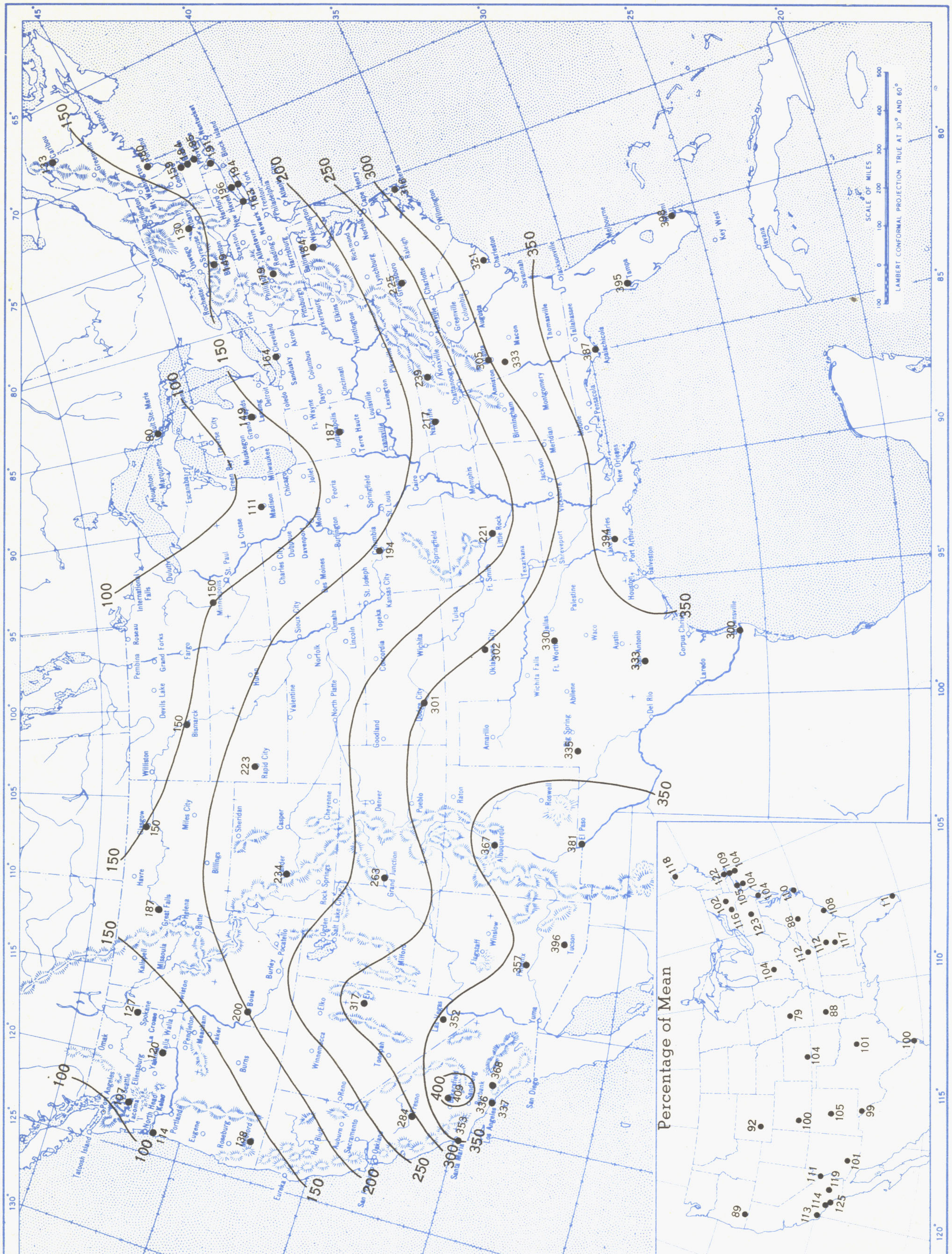
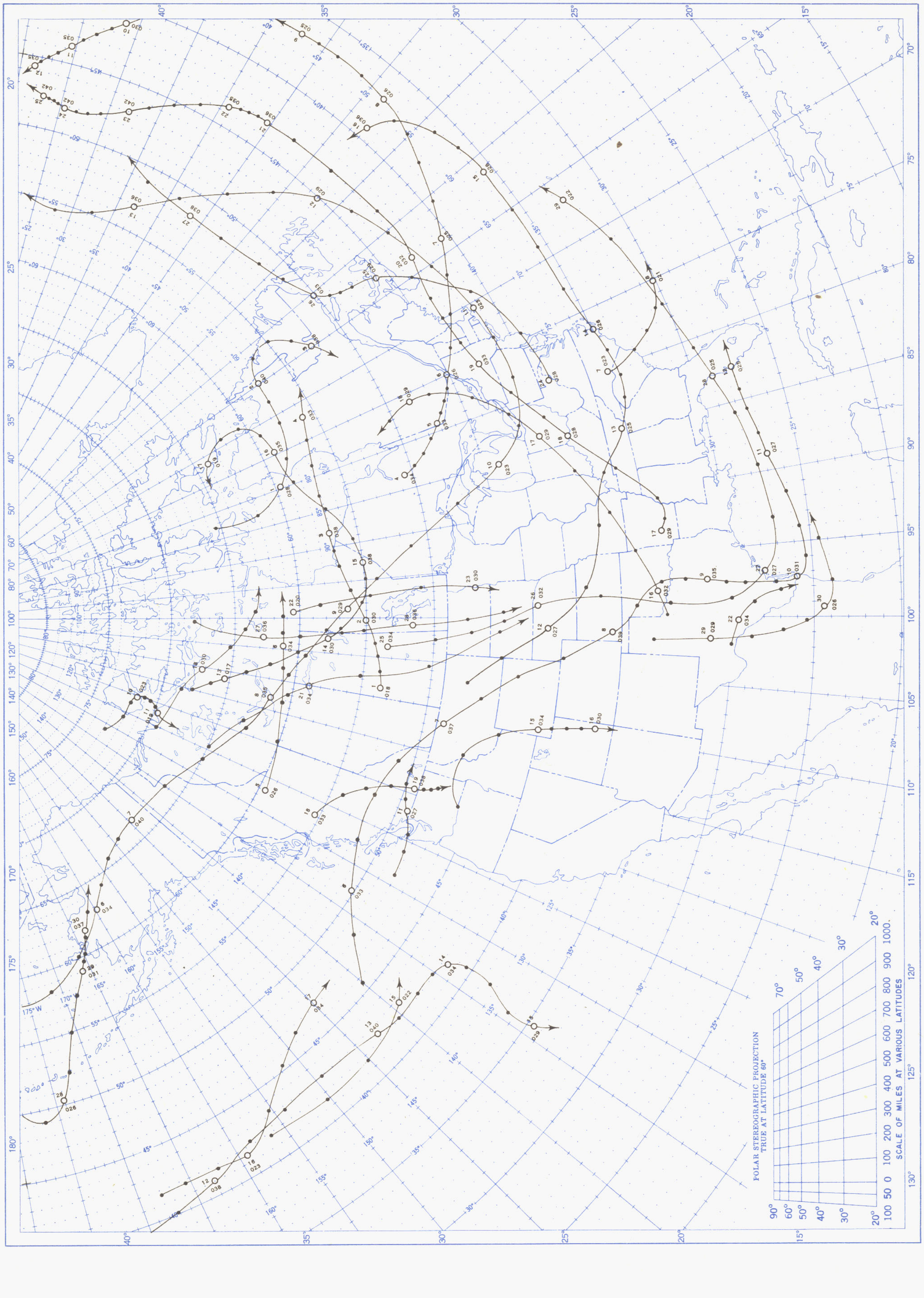


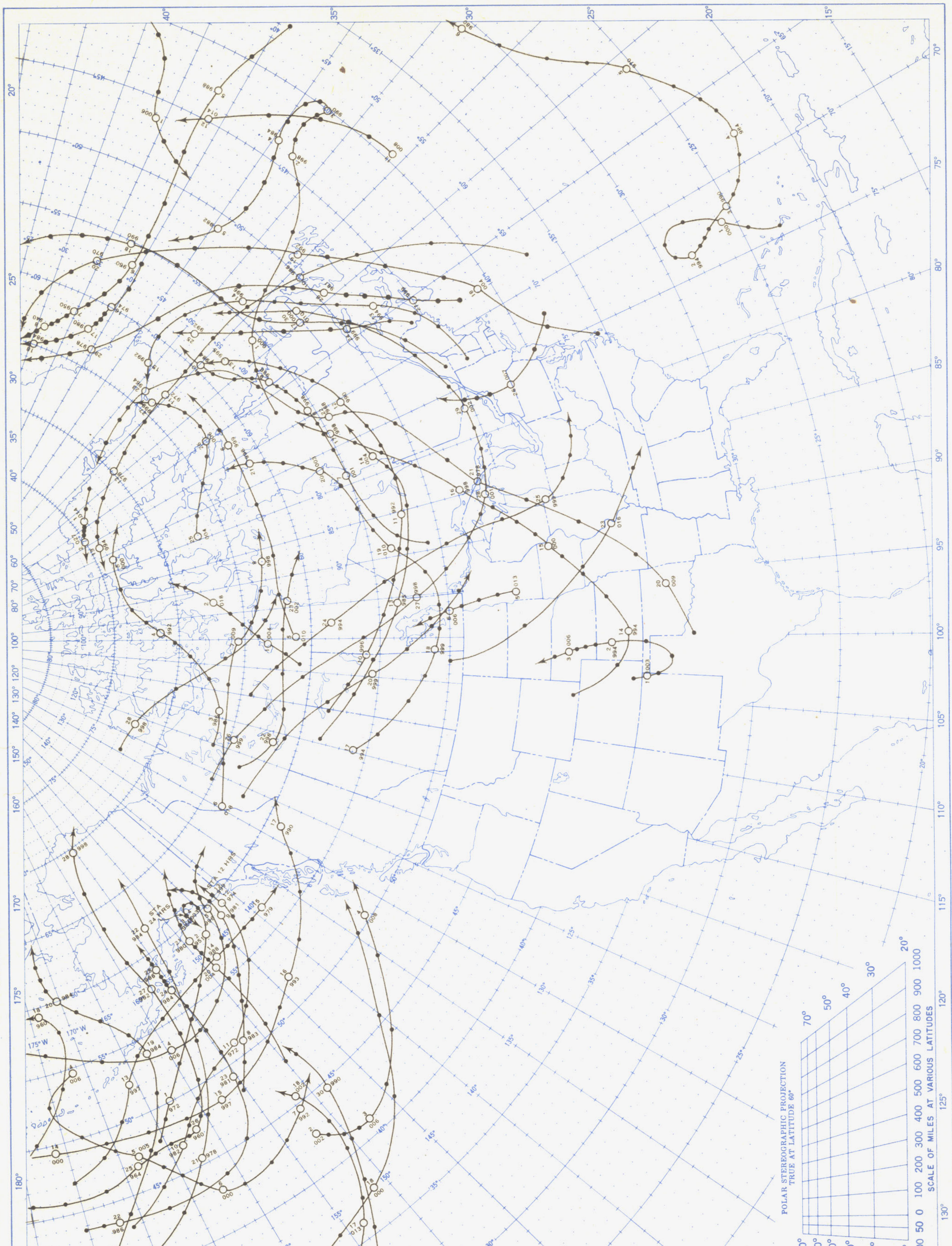
Chart shows mean daily solar radiation, direct + diffuse, received on a horizontal surface in langleys (1 langley = 1 gm. cal. cm. $^{-2}$). Basic data for isolines are shown on chart. Further estimates are obtained from supplementary data for which limits of accuracy are wider than for those data shown.

Chart IX. Tracks of Centers of Anticyclones at Sea Level, November 1956.



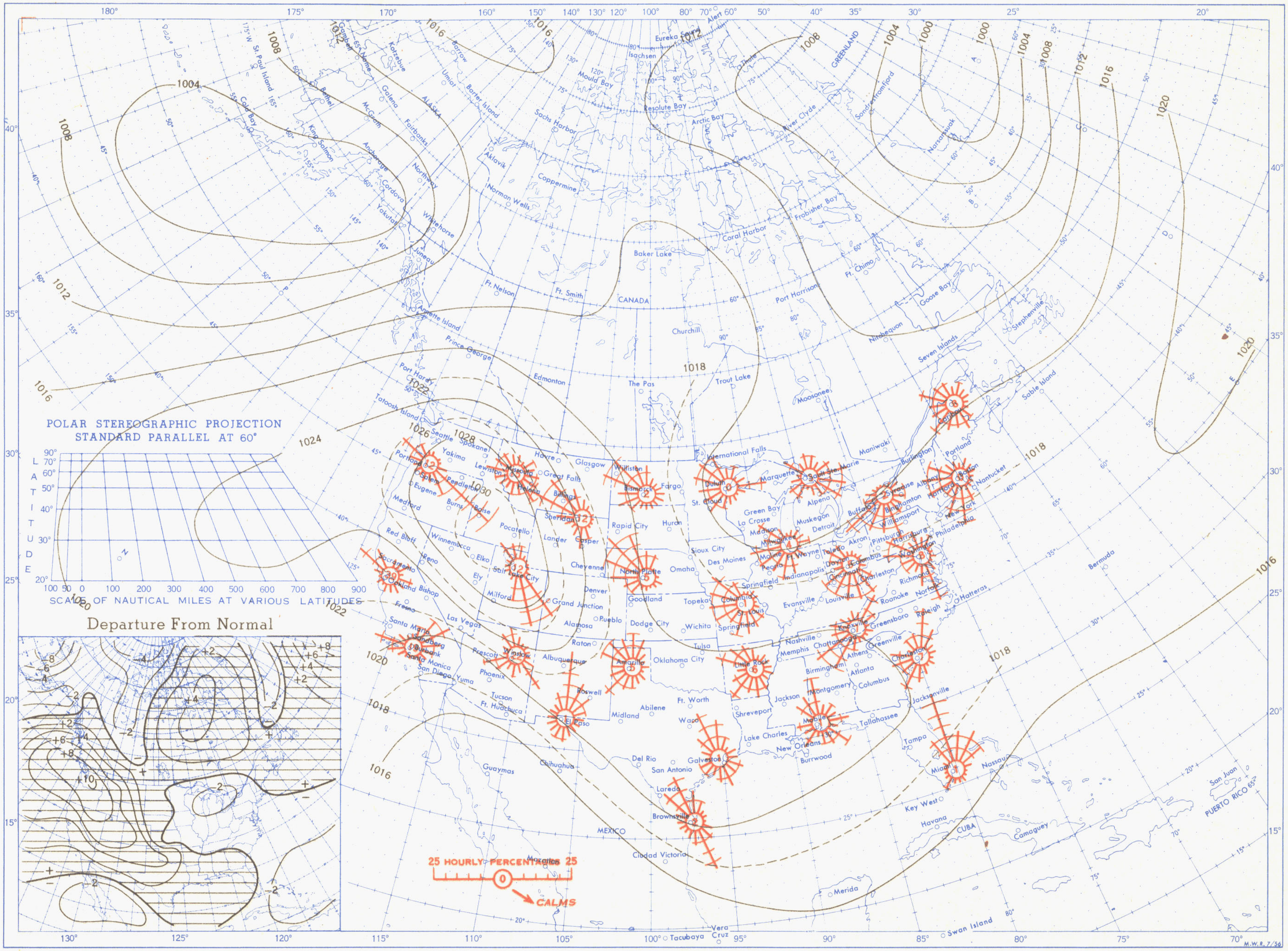
Circle indicates position of center at 7:30 a. m. E. S. T. Figure above circle indicates date, figure below, pressure to nearest millibar. Dots indicate intervening 6-hourly positions. Squares indicate position of stationary center for period shown. Dashed line in track indicates reformation at new position. Only those centers which could be identified for 24 hours or more are included.

Chart X. Tracks of Centers of Cyclones at Sea Level, November 1956.



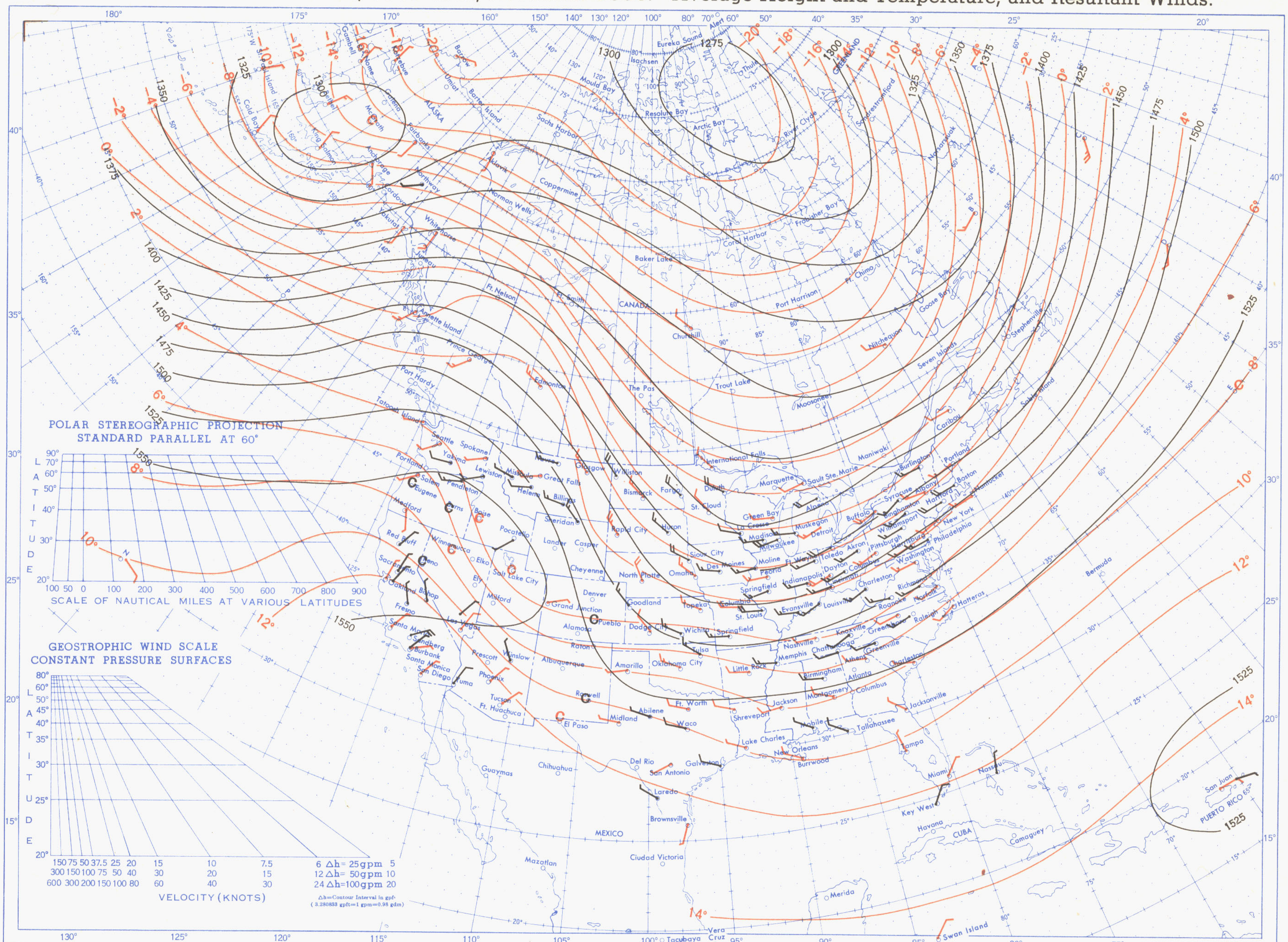
Circle indicates position of center at 7:30 a. m. E. S. T. See Chart IX for explanation of symbols.

Chart XI. Average Sea Level Pressure (mb.) and Surface Windroses, November 1956. Inset: Departure of Average Pressure (mb.) from Normal, November 1956.



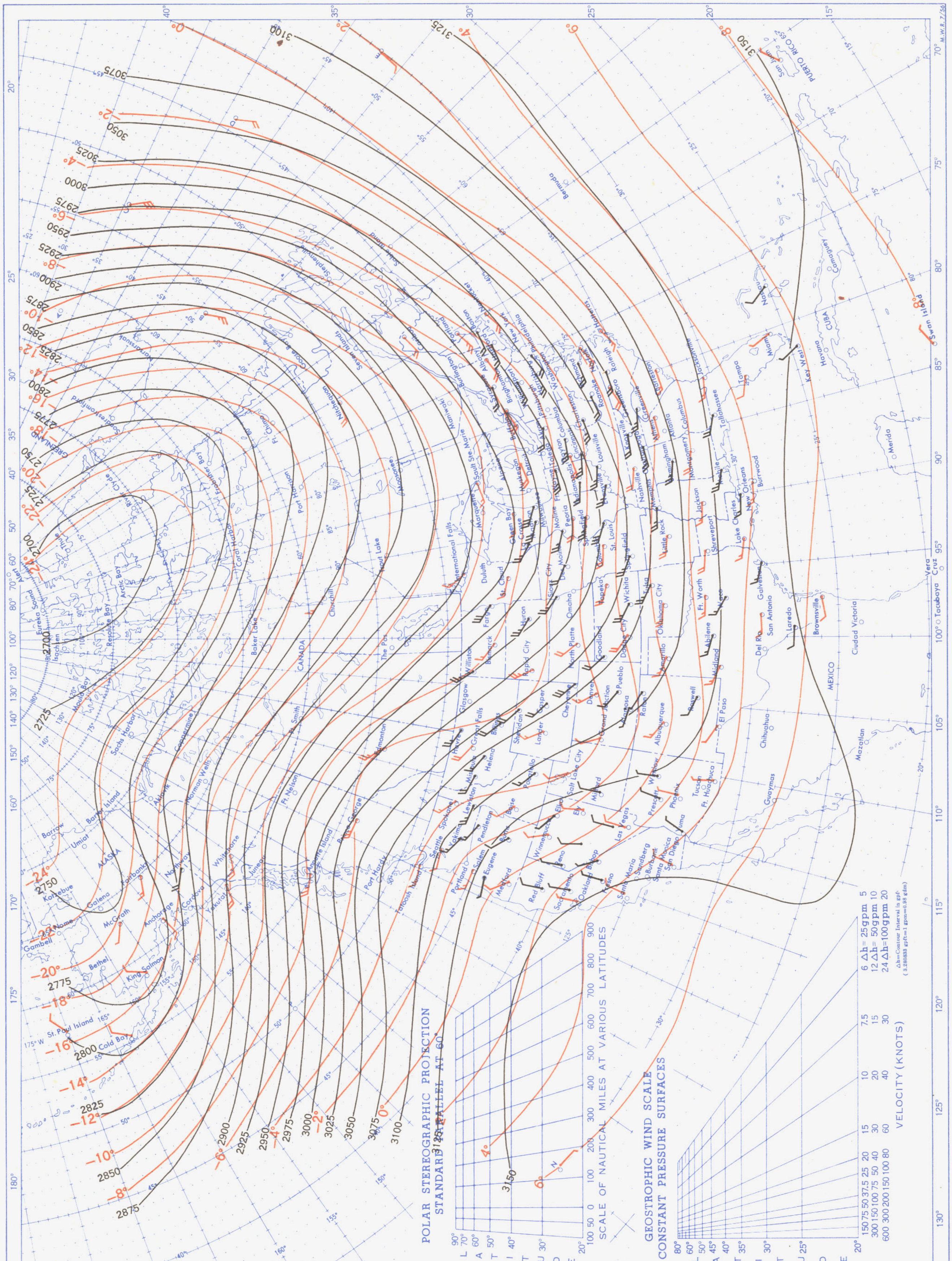
Average sea level pressures are obtained from the averages of the 7:30 a. m. and 7:30 p. m. E. S. T. readings. Windroses show percentage of time wind blew from 16 compass points or was calm during the month. Pressure normals are computed for stations having at least 10 years of record and for 10° intersections in a diamond grid based on readings from the Historical Weather Maps (1899-1939) for the 20 years of most complete data coverage prior to 1940.

Chart XII. 850-mb. Surface, 0300 GMT, November 1956. Average Height and Temperature, and Resultant Winds.



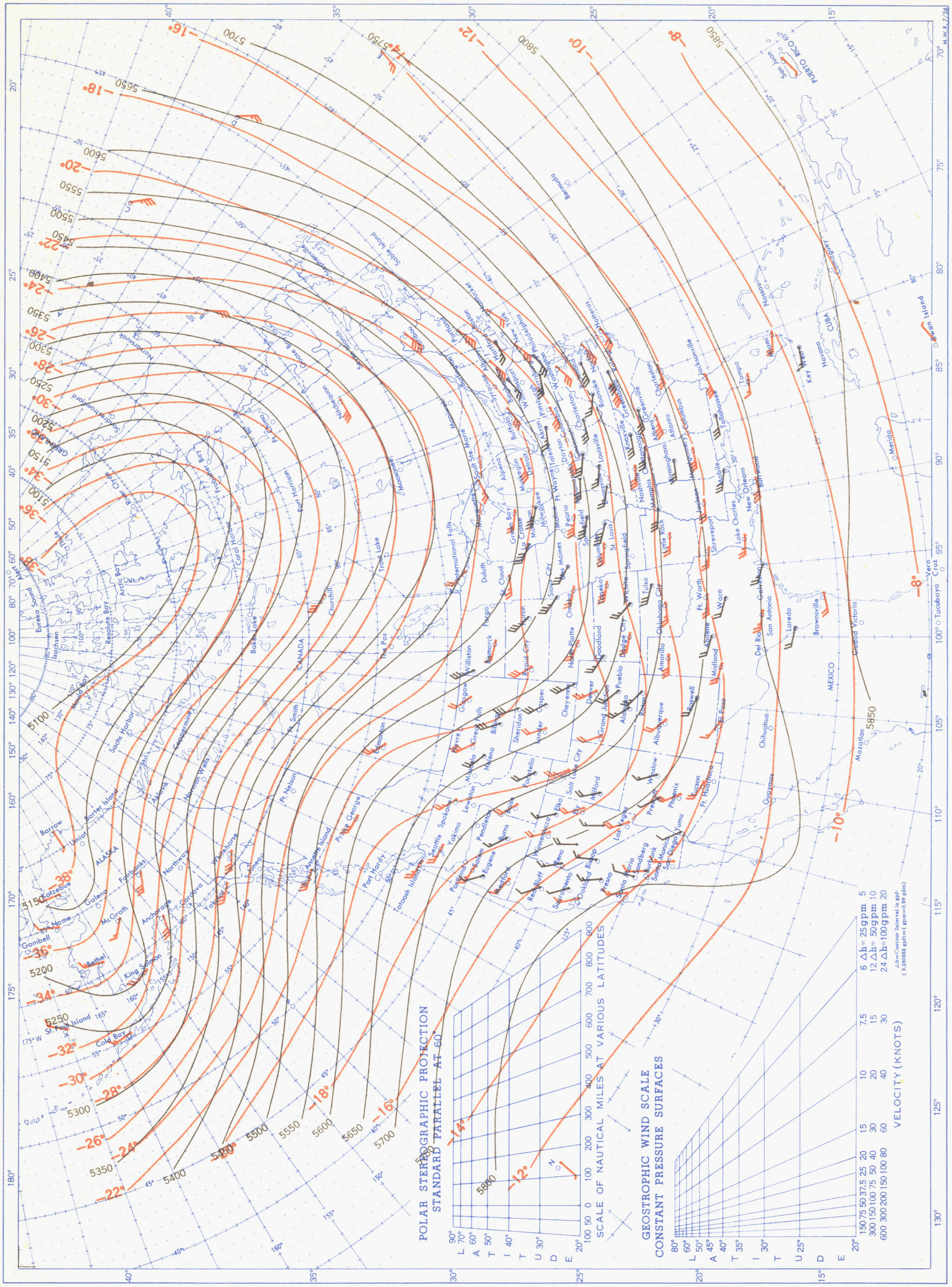
Height in geopotential meters (1 g.p.m. = 0.98 dynamic meters). Temperature in °C. Wind speed in knots; flag represents 50 knots, full feather 10 knots, and half feather 5 knots. Winds shown in red are based on rawins taken at the indicated pressure surface and time. Those in black are based on pibals taken at 2100 GMT and are for the nearest standard height level.

Chart XIII. 700-mb. Surface, 0300 GMT, November 1956. Average Height and Temperature, and Resultant Winds.



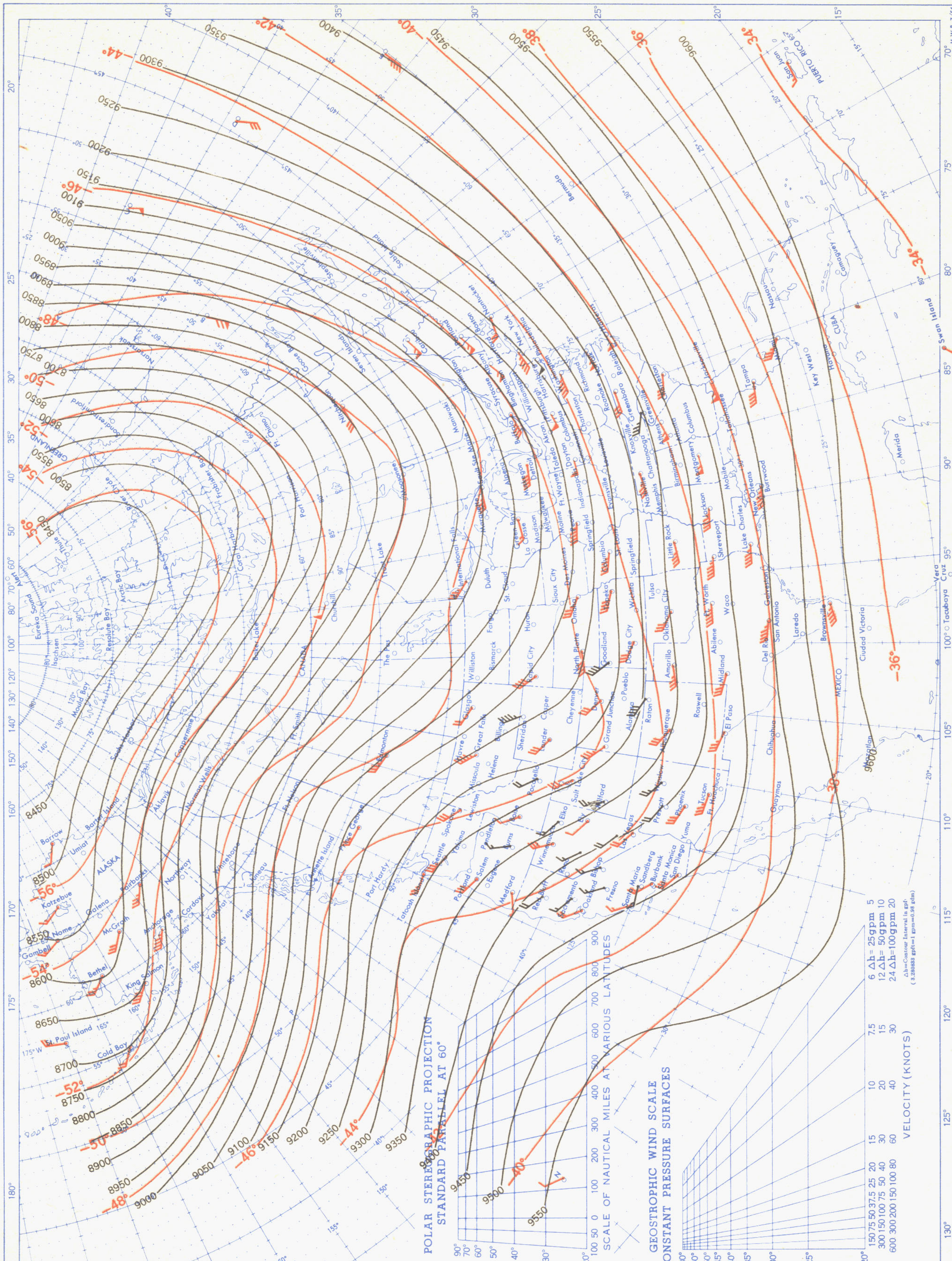
See Chart XII for explanation of map.

Chart XIV. 500-mb. Surface, 0300 GMT, November 1956. Average Height and Temperature, and Resultant Winds.



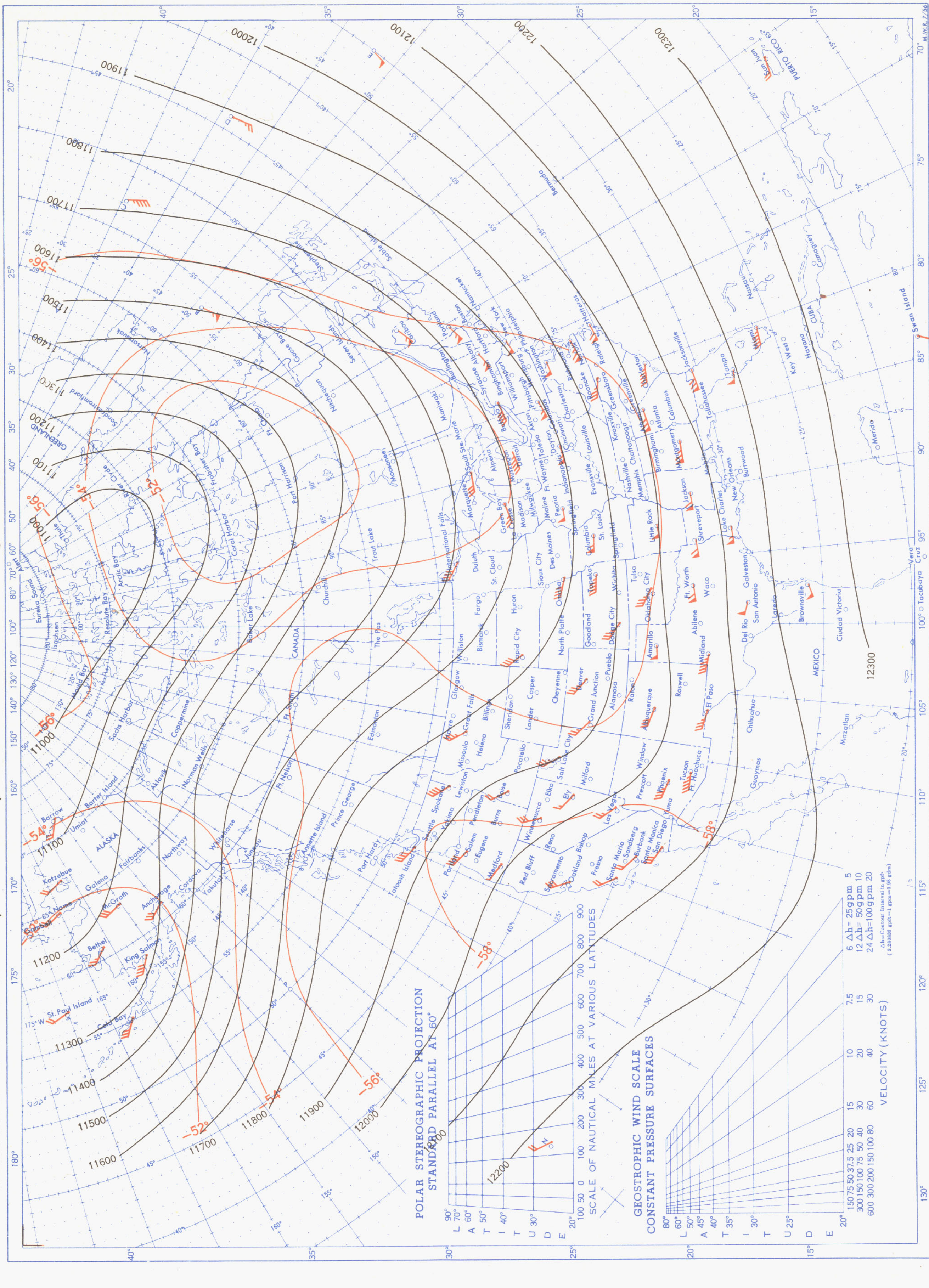
See Chart XII for explanation of map.

Chart XV. 300-mb. Surface, 0300 GMT, November 1956. Average Height and Temperature, and Resultant Winds.



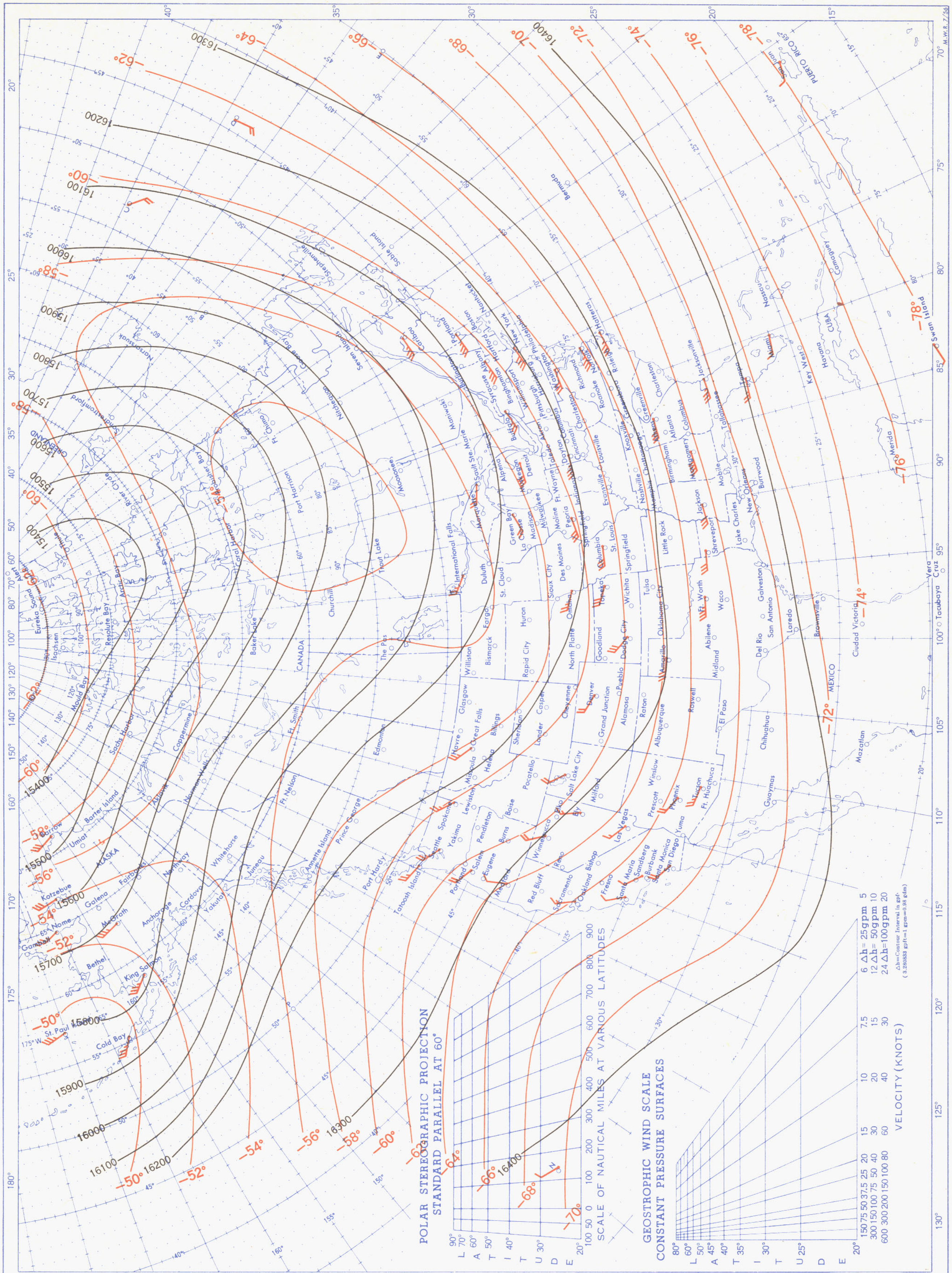
See Chart XII for explanation of map.

Chart XVI. 200-mb. Surface, 0300 GMT, November 1956. Average Height and Temperature, and Resultant Winds.



See Chart XII for explanation of map. All winds are from rawin reports.

Chart XVII. 100-mb. Surface, 0300 GMT, November 1956. Average Height and Temperature, and Resultant Winds.



See Chart XII for explanation of map. All winds are from rawin reports